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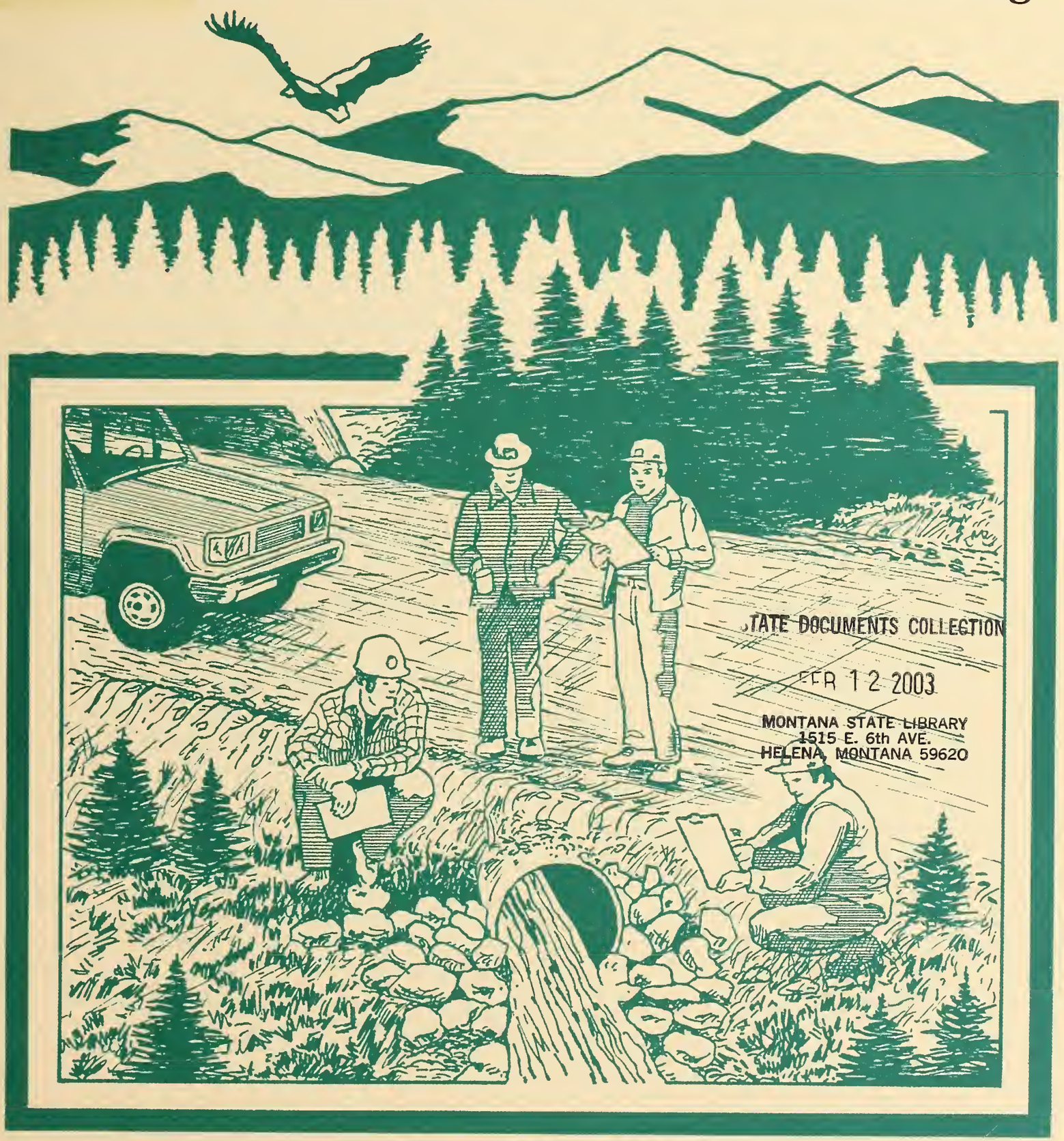

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FORESTRY BEST MANAGEMENT PRACTICES MONITORING

THE 2002 FORESTRY BMP AUDIT REPORT

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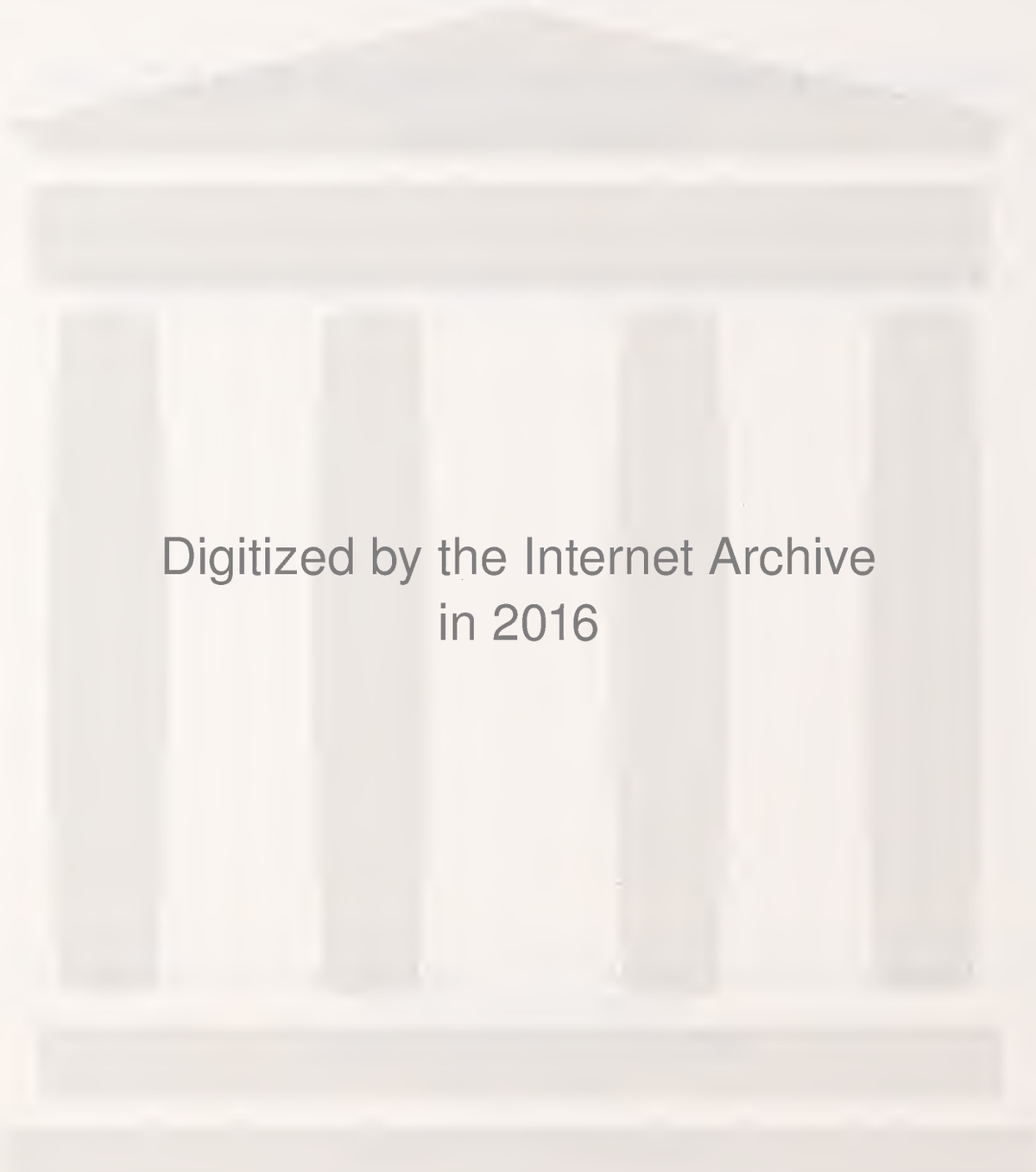
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ACKNOWLEDGMENTS

In 2002 the Service Forestry Bureau, Forestry Division of the Montana Department of Natural Resources and Conservation once more undertook the task of completing the Forestry Best Management Practices (BMP) audits. The Division graciously acknowledges the many people who gave their time and energy toward the audit effort. Special thanks go to the BMP Technical Working Group members who contributed to the task of reviewing the issues that arose from the 2000 audits as well as overseeing the entire process. A huge thank you to the audit team members who traveled extensively, worked long days in the field, and made many difficult decisions in a professional manner. Thanks also go to the Environmental Quality Council and Governor's Office, to all who supplied information to select the sites, and to those who gave access to private lands. Thanks to the representatives from Industry, the U.S. Forest Service, the Bureau of Land Management, and the Department of Natural Resources and Conservation Trust Land Management Division for their cooperation in providing audit site information and team members. Special thanks goes to Kate Kronen and Lynn Gruszie for creating and editing portions of this report. Finally, but with sincere gratitude and respect, thank you to Patrick Heffernan for your most excellent assistance with the2002 Audits, but more so for your years of dedication to the Best Management Practices concept, program, education and improvement. I wish you well in your new adventure.

EXECUTIVE SUMMARY

The Forestry Best Management Practice (BMP) audit process is used to evaluate whether BMPs are being applied and if they are effectively limiting non-point source pollution. The Governor has requested the Montana Department of Natural Resources and Conservation (DNRC), Forestry Division to evaluate forest practices for BMP implementation and report the findings to the EQC. This report summarizes the findings of Montana's 2002 forestry BMP audits, and complements similar study reports completed in 1990, 1992, 1994, 1996, 1998 and 2000.

Four interdisciplinary teams conducted the audits. Each team was composed of a fisheries biologist, a forester, a hydrologist, a representative of a conservation group, a road engineer, a soil scientist, and a non-industrial private forest (NIPF) landowner or logging professional. DNRC used established site selection criteria to choose forty-three (43) new timber harvest sites harvested since 1999. The selection criteria limited the sample to those sites most sensitive to the practices that affect water quality. The audit teams evaluated a maximum of fifty (50) BMPs at each site, rating application and effectiveness for each BMP on a five-point scale.

The audit teams evaluated forty-three (43) sites for **BMP application.** Audit results showed that across all ownerships, BMPs were properly applied ninety-six percent of the time. Although many harvest sites had at least one instance where a BMP was inadequately applied, the majority of these departures were minor and did not cause erosion or deliver material to a stream. Twenty-three percent of the sites had one or more major BMP departures in application. This is a thirteen percent increase over the 2000 audit results. The application of eight high risk BMPs was evaluated separately because they are among those most important for protecting soil and water resources. Ninety percent of these high risk BMPs were properly applied.

The audit teams also evaluated **BMP effectiveness**. Audit results showed that across all ownerships, BMPs were effective in protecting soil and water resources ninety-seven percent of the time. Thirty seven percent of the sites had some minor departures in BMP effectiveness. Minor departures in effectiveness produce minor impacts to soil and water resources; eroded material reaches draws but not streams. Thirty-five percent of the sites had one or more major departures in BMP effectiveness. This is a fourteen percent increase over the 2000 audits results. Ninety-two percent of the eight high risk BMPs evaluated were rated as providing adequate protection to soil and water resources.

The greatest frequency of departures from BMPs, and the most impacts, were associated with road maintenance and drainage. The text includes a list of problematic BMPs on page 22.

The audit teams also evaluated application and implementation of the Montana Streamside Management (SMZ) Law. There were six SMZ rules departures noted during all the audits. All but one of these were minor and produced no discernible impacts to soil and water resources.

Summary of BMP and SMZ Application and Effectiveness, by Ownership Group

Practice	DNRC	Federal	Industry	NIPF	Totals
BMP APPLICATION	98%	89%	98%	92%	96%
BMP EFFECTIVENESS	99%	89%	99%	95%	97%
SMZ APPLICATION	100%	100%	99%	97%	99%
SMZ EFFECTIVENESS	100%	100%	100%	99%	100%

Similar audits were conducted in 1990, 1992, 1994, 1996, 1998 and 2000. Two new BMPs and two existing BMPs were evaluated for the first time in 2002 – see Pages 9, 23 and 28.

Comparison of BMP Audit Results – 2002 with 2000, 1998, 1996, 1994, 1992 and 1990

Category	2002	2000	1998	1996	1994	1992	1990
Application of practices that meet or exceed BMP requirements.	96%	96%	94%	92%	91%	87%	78%
Application of high risk practices that meet or exceed BMP requirements.	90%	92%	84%	81%	79%	72%	53%
Number of sites with at least one major departure in BMP application.	10 of 43 (23%)	4 of 42 (10%)	8 of 47 (17%)	12 of 44 (27%)	17 of 46 (37%)	20 of 46 (43%)	27 of 44 (61%)
Average number of departures in BMP application, per site.	1.8	1.4	2	3	3.9	5.6	9
Percentage of practices providing adequate protection.	97%	98%	96%	94%	93%	90%	80%
Percentage of high risk practices providing adequate protection.	92%	93%	89%	86%	83%	77%	58%
Number of sites having at least one major/temporary or minor/prolonged impacts.	15 of 43 (35%)	9 of 42 (21%)	12 of 47 (26%)	15 of 44 (34%)	13 of 46 (28%)	17 of 46 (37%)	28 of 44 (64%)
Average number of impacts per site.	1.3	1	1.5	2.3	3	4.6	8

INTRODUCTION

The forest lands of Montana are also the headwaters for several major river basins and produce large quantities of high quality water. This water nurtures some of the West's best fisheries and is used for irrigation and livestock, as well as for domestic, recreational and industrial purposes. These same lands grow the timber resources that sustain the forest products industry, one of Montana's major industries. All products from Montana's 22.5 million acres of forest land contribute in an essential manner to Montana's economy and way of life.

Montana's water quality protection program for forestry involves a combination of regulatory and non-regulatory approaches. Since the 1970's, non-regulatory Forestry Best Management Practices have provided guidance as minimum water quality protection standards for forestry operations. In 1987 Congress amended the Clean Water Act and added Section 319 to address non-point sources of pollution. Section 319 directed all States to develop non-point source pollution plans to address non-point source pollution problems.

At this same time, concern over the impacts of forest management on Montana's watersheds prompted the 1987 Montana Legislature to pass House Joint Resolution 49. This resolution directed the Montana Environmental Quality Council (EQC) to study "how current forest management practices are affecting watersheds in Montana." (Zackheim, 1988) The EQC established a BMP technical committee that developed Montana's first statewide forestry BMPs in 1987. In 1989, after two years of work, an interdisciplinary working group released the revised Forestry Best Management Practices. Since that time, the BMP Work Group has overseen the biennial process. In the interim between the 1996, 1998 and 2000 audit cycles the BMP Work Group reviewed and revised the 1989 BMPs. The 2000 version of the Best Management Practices For Forestry In Montana were used in the 2002 audits (See Appendix A for the complete 2000 BMPs).

Forestry BMP audits have been conducted previously in Montana. As part of HJR-49, audit teams conducted the first statewide assessment of forest practices for BMPs during the summer of 1988 (Zackheim, 1988). In 1989, the University of Montana, under the Flathead Basin Water Quality and Fisheries Cooperative, audited more sites for BMPs in the Flathead River drainage (Ehinger and Potts, 1990). The Montana Legislature directed DNRC to conduct further series of statewide BMP audits in 1990, 1992, 1994, 1996 and 1998 (Schultz, 1990 and 1992; Frank, 1994; Mathieus, 1996; Fortunate, et al., 1998; and Ethridge and Heffernan, 2000).

Forestry BMPs, if properly applied, can limit non-point source pollution--the kind of diffuse pollution that forestry operations often produce, such as sediment from a road or timber harvest. The BMP audit process has been consistently used since 1990 to evaluate whether BMPs are being properly applied and if they are effectively limiting non-point source pollution.

Prior to 1989, forestry water quality was addressed through a voluntary approach as part of the State's 1988 non-point source assessment and management plan. In 1989 the Montana Legislature enacted the BMP Notification Law (76-13-101 MCA), which requires private landowners who plan to harvest timber to notify the state of their plans. Under this law, forestry BMP information is sent to landowners. Implementation of Forestry BMPs is administered within a non-regulatory framework.

Since October 1991 the Streamside Management Zone (SMZ) Law (77-5-301 307 MCA) has regulated forest practices along streams. This law prohibits certain forest practices along stream channels and directs suitable streamside management practices. The SMZ rules (36.11.301 - 310 ARM) became effective March 15, 1993 and were intended to help define and clarify the SMZ law. The 1992 BMP audits did not evaluate compliance with the SMZ law because most operations audited were completed prior to the effective date of the rules. Beginning in 1994, the audits were designed to provide preliminary information on the application and implementation of the SMZ law and rules, using a supplemental SMZ questionnaire.

In 1998 the format used to evaluate the SMZ law and rules was the same as the one used to evaluate the BMPs for application and effectiveness on a 5-point scale. DNRC's intent was to supply data that would be more easily summarized.

In 2001 the Governor requested the Montana Department of Natural Resources and Conservation (DNRC) Forestry Division to once again evaluate forest practices for BMP implementation and report to the EQC before the 2003 legislative session. This report summarizes the findings of Montana's 2002 forestry BMP audits.

The BMP audit process, which the EPA calls BMP implementation monitoring, is a widely-used means of evaluating forest practices. Implementation monitoring is a surrogate for water quality monitoring, a more quantitative approach. Water quality monitoring is a long-term and expensive endeavor. Water quality varies naturally due to variable geology, land forms, soils, and climatic events. Due to this variability, investigators have to collect large numbers of samples over a long period of time to accurately characterize water quality.

In Montana investigators use qualitative implementation audits to find out if BMPs are being applied and whether they are controlling erosion. Since BMPs are recognized by state and federal legislation as a method to control non-point source pollution, it makes sense to check the application and effectiveness of BMPs as part of such a program. States are increasingly relying on qualitative surveys, using interdisciplinary teams to assess forest practices on-site, to monitor their silvicultural non-point source control programs (NCASI, 1988). California, Idaho, Oregon, Utah, Minnesota, Washington, South Carolina, Texas and Florida all use a similar qualitative approach to assess the control of non-point source pollution from forest practices.

Montana, through the DNRC, has appointed a technical work group that has overseen the BMP process since its inception and provides recommendations to DNRC. The work group members represent a broad range of interests in forestry in Montana. Several members also serve on the audit teams and many have been involved with the program since 1988.

METHODS

Objectives

BMP audits have been conducted every two years beginning in 1990; 2002 represents the seventh cycle. The 2002 audits were conducted with similar objectives and criteria as the previous audits in order to produce comparable results.

In 2002, the objectives of the BMP field audits were to:

1. Determine if BMPs are being applied on timber harvest operations.

2. Evaluate the general effectiveness of BMPs in protecting soil and water resources.

3. Provide information on the implementation of the SMZ law and rules and assess general effectiveness of SMZs in protecting water quality.

4. Provide information to focus future educational or study efforts by identifying subjects and geographic areas in need of further attention or investigation.

5. Provide information on the need to revise, clarify, or strengthen BMPs.

The Study Area

The state of Montana is the study area. The state is broken into four geographical regions, Northwest, West, Central, and Eastern (Appendix B). For administrative ease the regional breaks are located on county lines.

Sample Size And Distribution

Historically the target for the number of sites to be audited was set at 45. This number was based on the interaction between the number of days volunteer audit team members could be expected to commit to the audit process and the number of audits a team could reasonably conduct in one day. The maximum time commitment for audit team members was established at 10 days. This is for all audit-related activities, which includes calibration training, conducting the audits and a post-audit critique workshop. It was determined that a request exceeding 10 days would likely jeopardize the ability of individuals to participate, thus restricting the ability to field the desired number of fully-staffed teams. An audit team can be expected to complete one to two audits per day depending on the regional distribution of sites and the travel time between sites. Based on the above expectations and assumptions, the target number of audits was set at 45.

The targeted 45 audit sites are distributed across the state by geographical region (see Study Area above) and land ownership group. The audit process recognizes four ownership groups: State of Montana Trust Lands (DNRC), U.S. Forest Service/Bureau of Land Management lands (Federal), private industrial lands (Industry) and non-industrial private forest lands (NIPF). The basis for audit site distribution is the proportion of the total statewide harvest volume that is harvested within each region by each ownership group. The 45 audit sites are allocated

proportionally among the regions. Harvest volumes were obtained from the 2000 State of Montana Cut By County Report and USFS, BLM and DNRC annual harvest volume records.

A total of 43 sites were audited during the 2002 BMP audits (see Table 1 for historical site information). This number is slightly lower than the generally targeted goal of 45 sites. Two sites selected during the screening process were eliminated after commencement of the audits. When field-checked, these sites did not meet the minimum site selection criteria and could not be replaced in a timely manner.

The 43 sites are a representative sample of logging operations conducted in Montana since 1999 **that meet specific selection criteria** (see Site Selection below). The selection criteria restrict the sample to those sites where on the ground timber harvest and timber management-related activities have the highest opportunity to impact water quality.

Table 1
Historical Number of Sites Audited by Ownership Group

Ownership Group	2002	2000	1998	1996	1994	1992	1990
DNRC	5	5	5	5	5	5	5
Federal	5	9	12	12	14	16	16
Industrial	21	18	18	14	14	16	16
NIPF	12	10	12	13	13	9	7
Total	43	42	47	44	46	46	44

See Appendix C for the list of audited sites.

Site Selection

In November of 2001 DNRC sent Industry, Federal and DNRC ownership group representatives a letter requesting potential BMP audit candidate sites. Each letter included a BMP Audit Site Information Form (see Appendix D) to be completed for each harvest operation that met the initial selection criteria (see below). Members of these ownership groups were very cooperative and provided essential information to DNRC. To obtain potential audit site information for NIPF ownership, DNRC searched its Hazard Reduction Agreements database and consulted with DNRC field service foresters for sites that met the initial criteria. The criteria for a candidate audit site was modified for the 2002 audits. In recent years several apparent trends in timber management practices have impacted the ability to generate audit sites meeting the established minimum criteria. These trends are more noticeable on certain ownerships and less on others. The intent of the audits is to have site representation from all ownerships in all regions where the individual ownerships own land. There is a general trend toward reduced volume per acre harvested and moving harvest activities farther from streams. As timber harvest per acre and harvest units within 200 feet of a stream are minimum criteria, there is again a trend toward less sites available for audit. Because of these issues, selection criteria were modified as outlined below.

The minimum criteria for a potential audit site remained the same:

- Timber harvest must have occurred during the years 1999, 2000 or 2001.
- A portion of the sale needed to be located within 200 feet of a stream.
- The target size for harvest units to be included in the audit process was five acres or greater.
- The target timber harvest removal was 5,000 board feet (5 MBF) per acre or greater for the west-side units; for east-side units the target was 3 MBF.

The site selection objective is to receive a minimum of five potential audit sites from each ownership group in each region (this would not apply if the ownership group did not own land in a specific region). If through using the minimum criteria at least 5 potential audit sites in one or more regions are not generated, the landowner would move to the second and third tiers until five sites can be submitted. Landowners must submit **all** sites that meet the minimum criteria. It is only if 5 sites in a region that meet the minimums cannot be generated that the second and third tiers are utilized.

Second Tier

- Sites harvested within three years prior to the audit.
- Minimum size and volume per acre:
    - West-side sites – 5 acres with 3,000 or more board feet per acre removed.
    - East-side sites – 5 acres with 1,500 or more board feet per acre removed.
- A harvest unit must be within 200 feet of a stream (SMZ definition of a stream)

Third Tier

- Sites harvested within three years prior to the audit.
- Minimum size and volume per acre:
    - West-side sites – 5 acres with 5,000 or more board feet per acre removed.
    - East-side sites – 5 acres with 3,000 or more board feet per acre removed.
    - Road system has stream crossings located on the ownership groups property within the audited project area.

Sites that met the initial criteria were further stratified into seven prioritized groups depending on the forest management-related activities conducted at the site. The intent of this stratification was to maximize the number of BMPs evaluated. These groups were as follows:

- Priority 1 - Riparian harvest, new road construction or reconstruction, stream crossing culvert installation and slash disposal complete.
- Priority 2 - Stream within 200 feet of a harvest unit, new road construction or reconstruction, stream crossing culvert installation, slash disposal complete.
- Priority 3 - Stream within 200 feet of a harvest unit, new road construction or reconstruction, stream crossing culvert installation, slash disposal incomplete.
- Priority 4 - Stream within 200 feet of a harvest unit, new road construction or reconstruction, stream crossing without new culvert installation, slash disposal complete.
- Priority 5 - Stream within 200 feet of a harvest unit, new road construction or reconstruction, stream crossing without new culvert installation, slash disposal incomplete.

- Priority 6 - Stream within 200 feet of a harvest unit and slash disposal complete.
- Priority 7 - Stream within 200 feet of a harvest unit and slash disposal incomplete.

Road construction activities must have occurred during 1997 or later.

Once all potential sites were received, DNRC assigned each site a priority number based on the information supplied on the BMP Audit Site Information Form (Appendix D). Sites were then stratified by Region and Ownership Group. Actual audit sites were then selected by Region and Ownership Group beginning with Priority 1 sites and progressing through other Priority levels as needed until the targeted distribution was met.

In 2002 all selected audit sites were initially rated as either Priority 1, 2, or 3 sites.

Additional considerations went into final site selection:

- An audit goal was to have two-thirds of the audits located on high hazard sites and one-third located on low to medium erosion hazard sites. High hazard sites are sites with either riparian harvest, harvest within an SMZ, high soil erosion potential, or combinations of these. Erosion hazard was determined using the erosion hazard matrix developed by the Montana Riparian Association (Appendix E). It was believed that the prioritization process would produce this outcome. Table 2 shows the percentage of audited sites that, based on field evaluation, met the high hazard criteria.

- Logistics is also considered as a determinant of the sites selected. Sites of equal priority level could be exchanged to accommodate reasonable team travel.

Table 2
Percentage of Sites Meeting High Hazard Criteria

Ownership Group	Number of Sites	Number of High Risk Sites	Percentage of High Risk Sites	Number of Sites With Riparian Harvest
DNRC	5	3	60	2
Federal	5	2	40	1
Industry	21	21	100	18
NIPF	12	8	67	7
All Sites	43	34	80	28

An associated site selection issue is that of access to potential audit sites. BMP audits are voluntary, and thus permission to access a site must be granted by the landowner group or, in the case of NIPF lands, the individual landowner. The DNRC, Federal and Industry ownership groups have all agreed to unrestricted access to BMP audit sites, and access is not an issue. In the case of non-industrial private land, DNRC must obtain permission from each individual landowner prior to conducting an audit on their property. In order to accomplish this, DNRC made an initial contact by telephone to request permission to audit individual timber harvest

sites. If access was granted, a follow-up letter was sent to each landowner explaining the purpose of the audit process as well as DNRC's policy toward enforcement actions.

The sample size and sites selected DO NOT represent a sample of all timber harvest operations in Montana--ONLY those meeting site selection criteria. These selected sites are those located in proximity to streams and therefore have the greatest potential for non-point source pollution to occur.

The Audit Teams

Four audit teams were formed to conduct the 2002 audits--one for the northwestern, one for the western, one for the central, and one for the eastern parts of the state. These teams were composed of seven members--a fisheries biologist, a forester, a hydrologist, a representative of a conservation group, a road engineer, a soil scientist, and a shared position of logging professional or representative of non-industrial private forest landowners (NIPF). A member of each audit team was assigned to lead the team. The team leader was responsible for providing general leadership and direction as well as filling out the official rating form and overseeing the logistics of the team. Team members were employees of federal and state agencies, private industry, conservation organizations, independent consultants, or volunteers.

Two training sessions were conducted prior to the actual audits: one for the Northwest and West teams and one for the Central and East teams. These sessions served as a refresher to those with previous experience and as a calibration to the new team members. All team members, including alternates, were strongly encouraged to attend one of these sessions. The goal was to have the audit teams establish a consistent method of rating that could carry through the rest of the audits. Team members and alternates met for several hours of classroom instruction on the BMP audit process and then evaluated a sample audit site in the field. The team members shared their results with the other members and identified and discussed their differences and ways to be consistent. See Appendix F for a complete list of team members.

The Rating Form

The audit teams used a rating form similar to that of previous audits. **Between the 2000 and 2002 Audits the BMP Audit Technical Group added two new BMPs and reestablished two existing BMPs as audited BMPs**. The new BMPs are (see Appendix A) III.C.2 ephemeral draw culverts and V.D.1 existing stream crossing culverts. The reestablished audited BMPs are IV.B.2 avoid equipment operation in isolated wetlands and III.C.4 install culverts at the gradient of the original ground slope. The guide for rating application and effectiveness was the same as that used in the previous audits. The audit teams evaluated a maximum of 50 BMP practices and 10 SMZ practices at each site. The rating of application and effectiveness for each was done on a 5-point scale, as in the past. See Appendix G for a copy of the rating form.

The audit team rated the application of BMPs by first noting if the BMP was applicable to the site and, if so, whether it was applied to the correct technical standard, at the correct frequency, and in the proper locations. The audit teams used a flow chart or decision tree to help rate application and effectiveness and, again, to keep the rating consistent. See Appendix H.

Lack of adequate application or misapplication are departures from the BMPs. The rating guide for the application of BMPs is:

5 - Operation exceeds requirements of BMP.
4 - Operation meets requirements of BMP.
3 - Minor departure from intent of BMP.
2 - Major departure from intent of BMP.
1 - Gross neglect of BMP.

The following description of the rating guide is adapted from Ehinger & Potts, 1990. Ratings of 5 and 4 are self-explanatory. The 3 rating, minor departure, applies to departures of small magnitude distributed over a localized area, or over a larger area where potential for impact is low. The 2 rating, major departure, applies to departures of large magnitude or to BMPs being repeatedly neglected. The 1 rating, gross neglect, applies where risks to soil and water resources were obvious, yet there was no evidence indicating that operators had applied BMPs to protect these resources.

The effectiveness rating addresses how well the application of the applied BMP worked. This rating answers questions concerning impacts; for example, "Has the application or misapplication of a particular forest practice increased the likelihood of, or actual occurrence of, sediment delivery to streams?" Lack of effectiveness results in impacts.

The rating guide for effectiveness was:

5 - Improved protection of soil and water resources over pre-project condition.
4 - Adequate protection of soil and water resources.
3 - Minor and temporary impacts on soil and water resources.
2 - Major and temporary, or minor and prolonged, impacts on soil and water resources.
1 - Major and prolonged impacts on soil and water resources.

The work group defined these terms prior to the 1990 audits to help the audit teams use them consistently:

Adequate--Small amounts of material eroded; material does not reach draws, channels, or floodplain.
Minor--Some material erodes and is delivered to draws but not to stream.
Major--Material erodes and is delivered to stream or annual floodplain.
Temporary--Impacts lasting one year or less; no more than one runoff season.
Prolonged--Impacts lasting more than one year.

Occasionally a BMP did not apply on a site. Some sites did not have stream crossings or new road construction; most sites did not have borrow pits; in several instances, slash disposal and site preparation had not been completed. In other cases, the audit team could not rate the BMP at the time of the audit--BMPs having to do with timing of operations during the harvest cannot be judged post-harvest. When these situations occurred, the team noted on the form that the practice did not apply, and no rating was given. In 2002, a maximum of 2,140 practices (43 sites, 50 BMPs) could have been rated. 1,743 (83%) practices were rated. 94 percent of all possible SMZ practices were rated (405 of 430).

In addition to the 50 BMPs evaluated, the audit form contains two general questions in Section VII (Appendix G) addressed by the audit team. One questions addresses the issue of overall reductions in sediment delivery to streams as a result of road improvements to existing road systems. The second addresses the third party road system. See discussions of each question later in this report.

Audit Site Inspections

The teams conducted the audits from late June through early August of 2002. The field routine consisted of team members, landowner representatives and observers meeting at a central location prior to each audit. Teams travel to the audit site. When in the general area of the site but before actually entering the road system to access the harvest area or the actual harvest area, there is a stop to discuss the specifics of audit process. The team leader provided maps and audit forms. Usually a representative of the landowner will brief the team by giving background information on the silvicultural prescription, time of operation, and associated practices. The final decisions as to which roads and harvest units will be audited are then made. All decisions as to audited roads, SMZs, new culvert installations and harvest units are determined before the team enters the road system or harvest area. Once on site, team members walked the site, reviewing BMP practices conducted in the predetermined areas. Teams typically spent about two hours inspecting each site.

After finishing the inspection, the team gathered to determine BMP ratings while still on site. The team leader is charged with leading the discussion and recording the consensus rating for each item on the rating form. For ratings where the team could not reach a consensus, the team took a vote and recorded the rating with the most votes. The team leader noted dissenting opinions in the Comments section. Teams almost always reached a consensus. Many observers attended the audits and gave feedback when requested but were not allowed to participate in the rating or to lobby for a particular score.

Limitations of the Audit Methods (in part, adapted from Idaho DHW, 1989.)

In analyzing the audit results, readers need to consider the limitations of the techniques used in the audit. The audit technique consisted of a one-time field inspection and assessment. This approach documents erosion and sedimentation problems which occur in the first or second year after harvest. This is generally the critical period for erosion associated with timber harvests. Some practices conducted during harvest cannot easily be evaluated in post-harvest audits. The assessment was based on visual appraisals of practices and impacts to surface soils and streams. The results are a "snapshot in time" of the practices and subsequent impacts. They do not necessarily reflect future impacts. During the 1998 audits, sites previously audited in 1996 and 1994–i.e., four- to six-year-old sites–were examined for long-term impacts. This information can be found in the 1998 Forestry BMP Audit Report (Fortunate et. al.)

Sites were split among four teams. Although rating inconsistency between teams should not be overlooked, its effect is probably minor due to the interaction between teams and the continuity of experienced team members. DNRC monitors each team to evaluate and promote consistency.

Auditors may rate several practices connected with one action. In some cases, one action may result in more than one rating. For example, if a skidder operates extensively in the Streamside Management Zone, the practice may rate poorly under both "Adequate SMZ Maintained" and "Equipment Operation Minimized in SMZ."

Even given these limitations, the BMP audit process is an effective way to evaluate the implementation of BMPs. In addition, the audit process has helped promote BMPs and encourage landowners and operators to protect water quality on managed forests.

RESULTS

This section presents the results of the 2002 BMP field audits. Results will be in four parts: BMP Application, BMP Effectiveness, High Risk BMPs, and SMZ Results.

Results will be presented in three formats: summary data for BMP practices (Tables 3 and 6), summary data for audited sites (Tables 4 and 7), and a listing of the specific BMPs that incurred departures and impacts (Tables 5 and 8). For reference, Appendix I presents a summary tabulation of ratings by individual BMP.

Application of BMPs

The application rating measures whether the BMP was applied, whether it was applied to the correct standards, the appropriate number of times and in the proper locations. See "The Rating Form" section on page 9 for further explanation of the application rating. The audit teams rated a total of 1,743 practices to assess how landowners and operators applied BMPs. SMZ practices were rated separately. Tables 3, 4 and 5 present results relevant to BMP Application.

Table 3
Application of BMPs to All Rated Practices
by Ownership Group and Rating Category

		Percent (%) Practices Rated As			
Ownership Group	# Practices Rated	Meet or Exceed	Minor Departures	Major Departures	Gross Neglect
DNRC	215	98%	2%	<1%	0%
Federal	178	89%	7%	4%	0%
Industrial	898	98%	2%	<1%	0%
NIPF	452	92%	6%	2%	0%
All Sites	1,743	96%	3%	1%	0%

Practices were applied correctly 96% of the time. In terms of departures (Table 3), of the 1,743 practices evaluated, 4% of the practices had departures, 59 ratings of 3 (minor departures) and 17 ratings of 2 (major departures). There were no ratings of 1 (gross neglect).

Table 4 details the percentage of **sites** with application departures and average number of departures per site. The table shows that 60% of the sites audited were producing at least minor departures, at an average of 1.4 departures per site. Twenty-three percent of all sites were producing major departures--an average of .39 per site. Thirty-three percent of the sites had no departures.

Table 4
Audit Sites with Departures from BMP Application and Average Number of Departures per Site

		Percentage of Sites w/out Impacts	Percentage (%) of Sites with Departures			Average Number of Departures Per Site*		
Ownership Group	Total # of Sites	Adequate or Improved Protection	Minor	Major	Gross	Minor	Major	Gross
DNRC	5	60%	60%	0%	0%	1.0	0	0.00
Federal	5	0%	80%	80%	0%	2.4	1.6	0.00
Industrial	21	48%	52%	4%	0%	.7	.05	0.00
NIPF	12	8%	75%	42%	0%	2.2	1.5	0.00
All Sites	43	33%	60%	23%	0%	1.4	.39	0.00

* # of Departures/Total # of Sites

In Table 4, each category of departures must be considered separately, since a site may have departures in more than one category.

Table 5 identifies the specific BMPs where departures occurred. The list is ordered from most to fewest departures.

Table 5
Individual BMP Practices* Where Application Departures Occurred and a Summary of the Ratings Given

SECTION	BMP SUBSECTION	BMP	2 Rating Departures	3 Rating Departures	Total Departures
III	C	1	4	11	15
III	C	7	2	5	7
V	B	1B	3	4	7
V	D	1	3	4	7
III	E	2	0	6	6
III	C	3	1	4	5
III	D	5	1	3	4
III	C	5	0	3	3
III	C	4	0	3	3
V	C	4	0	2	2
V	C	6	0	2	2
IV	A	5	0	2	2
III	C	2	0	2	2
III	D	6	0	2	2
III	E	1	0	1	1
III	E	3	0	1	1
V	C	2	0	1	1
III	D	3	1	2	1
III	E	8	1	0	1
IV	B	5	0	1	1
TOTALS			17	59	76

* See Appendix A for a description of individual BMPs.

Effectiveness of BMPs

The effectiveness rating evaluates how well BMPs protected soil and water resources. See page 10 for further explanation of the effectiveness rating. The audit teams evaluated a total of 1,743 practices for effectiveness. Table 6 provides a summary of the effectiveness of all practices audited, by ownership group.

The effectiveness information in Table 6 should be used with thoughtful discretion. While simple percentage ratings may be relatively high for the category Adequate Protection (97%), less than adequate effectiveness of an individual BMP will result in impacts.

Adequate protection was provided 97% of the time. In terms of impacts (Table 8), of 1,743 practices evaluated, 57 practice departures had impacts, 25 ratings of 3 (minor temporary impacts), 30 ratings of 2 (major temporary or minor prolonged impacts), and 2 ratings of 1 (major and prolonged impacts).

Table 6
Effectiveness of BMPs for All Rated Practices
by Ownership Group and Rating Category

Ownership Group	Number of Practices Rated	Percentage (%) Practices Rated As			
		Adequate Protection	Minor/Temp. Impacts	Major/Temp., Minor/ Prolonged	Major/ Prolonged
DNRC	215	99%	1%	0	0
Federal	178	89%	4%	7%	0
Industrial	898	99%	<1%	<1%	0
NIPF	452	95%	2%	3%	<1%
All Sites	1,743	97%	1%	2%	<1%

Table 7 lists the percentage of sites with impacts and average number of impacts per site. The table shows that 37 percent of the sites audited had at least minor/temporary impacts--an average of .58 per site. Four percent of all sites had major/temporary impacts--an average of .7 per site.

Table 7
Audit Sites with Impacts and Average Number of Impacts per Site

Ownership Group	Total # of Sites	Percentage (%) of Sites w/out Impacts	Percentage (%) of Sites With Impacts			Average Number of Impacts per Site*		
		Adequate or Improved Protection	Minor/ Temp.	Major/Temp., Minor/ Prolonged	Major/ Prolonged	Minor/ Temp.	Major/Temp. Minor/ Prolonged	Major/ Prolonged
DNRC	5	40%	40%	0	0	.60	0	0
Federal	5	0%	60%	100%	0	1.4	2.6	0
Industrial	21	57%	29%	19%	0	.33	.24	0
NIPF	12	33%	33%	50%	17%	.67	1.0	1.7
All Sites	43	42%	37%	35%	4%	.58	.70	<.05

* # of Impacts/Total # of Sites

Table 8 identifies the specific BMPs where impacts occurred. The list is ordered from most to fewest departures.

Table 8
Individual BMP Practices* Where Effectiveness Impacts Occurred and a Summary of the Ratings Given

Section	BMP Subsection	BMP	1 Rating	2 Rating	3 Rating	Total Effects Impacts
III	C	1	0	6	5	11
V	B	1B	1	4	2	7
III	C	7	0	4	3	7
III	E	2	0	2	3	5
V	D	1	1	2	1	4
III	C	3	0	2	2	4
V	C	3	0	0	3	3
III	D	3	0	2	1	3
III	D	5	0	1	1	2
III	D	2	0	2	0	2
V	C	2	0	1	1	2
III	C	4	0	0	1	1
III	E	8	0	1	0	1
III	D	6	0	0	1	1
V	C	4	0	1	0	1
III	C	5	0	1	0	1
III	D	10	0	1	0	1
III	E	3	0	0	1	1
TOTALS			**2**	**30**	**25**	**57**

*See Appendix A for a description of individual BMPs.

High Risk BMPs

Simple percentages alone will not give a clear picture of the application and effectiveness of Montana's BMPs. Even a low percentage of misapplied BMPs can still result in major impacts. Additionally, all practices evaluated can affect water quality, but their potential impacts vary greatly. For example, drainage from a skid trail half a mile from a stream will not have as direct an impact on water quality as providing adequate road surface drainage at a stream crossing. In an effort to gain insight regarding the practices with the higher potential to directly impact water

quality, eight high risk BMPs have been identified and analyzed separately. They are among the most important for protecting Montana's watersheds. They include:

BMP Number	Practice Description
III.C.1	Provide adequate road surface drainage for all roads.
III.C.6	Route road drainage through adequate filtration zones before entering a stream.
III.D.2	Stabilize erodible soils (i.e., seeding, benching, mulching).
III.E.2	Maintain erosion control features (dips, ditches and culverts functional).
IV.A.5	Design and locate skid trails to avoid concentrating runoff.
IV.B.5	Adequate drainage for temporary roads, skid trails, fire lines.
IV.C.8	Limit water quality impacts of prescribed fire.
V.C.4	Prevent erosion of culvert and bridge fills (i.e., armor inlet and outlet).

The results for application and effectiveness of the eight high risk BMPs is presented in Tables 9 and 10. Table 11 shows a comparison between All BMPs and High Risk BMPs.

Table 9 shows the BMP application for the eight high risk BMPs that were evaluated separately. The percentage of practices with departures is higher for the high risk group (Table 9) than for all audited practices (Table 3), as shown in Table 11.

Table 9
Application of High Risk BMPs
by Ownership Group and Rating Category

		Percent (%) Practices Rated As			
Ownership Group	# Practices Rated	Meet or Exceed	Minor Departures	Major Departures	Gross Neglect
DNRC	39	95%	3%	3%	0%
Federal	35	77%	14%	9%	0%
Industrial	164	96%	4%	0%	0%
NIPF	87	83%	14%	3%	0%
All Practices	325	90%	8%	2%	0%

Table 10 shows the effectiveness of the eight high risk BMPs. The percent of practices providing adequate protection is lower for the high risk BMPs (Table 10) than for the total BMP results presented in Table 6. The percent of practices resulting in impacts are higher for the high risk BMPs than for practices in general (Table 11).

Table 10
Effectiveness of High Risk BMPs
by Ownership Group and Rating Category

Ownership Group	Number of Practices Rated	Adequate Protection	Minor/Temp. Impacts	Major/Temp., Minor/ Prolonged	Major/ Prolonged
DNRC	39	92%	5%	3%	0%
Federal	35	77%	9%	14%	0%
Industrial	164	97%	2%	1%	0%
NIPF	87	87%	6%	7%	0%
All Practices	325	92%	4%	4%	0%

Table 11
BMP Application and Effectiveness
All vs. High Risk

Application	Meet or Exceed	Minor Departure	Major Departure	Gross Neglect
All	96%	3%	1%	0%
High Risk	90%	8%	2%	0%

Effectiveness	Meet or Exceed	Minor Departure	Major Departure	Gross Neglect
All	97%	1%	2%	<1%
High Risk	92%	4%	4%	0%

Streamside Management Zones

There is a somewhat different purpose in auditing SMZ rules compared to BMP practices. They both are designed to protect water quality. However, auditing SMZ law activities is a non-regulatory look at SMZ rules compliance, whereas BMPs are, by definition, non-regulatory.

The same SMZ rating form was used in 2002 as was used in the 2000 audits (Appendix G). A maximum of ten practices were rated on each site in 2002. The practices rated were taken from the SMZ rules. The scoring was the same as the 50 BMP practices with a 5-point rating scale. **These ratings did not constitute an investigation or a DNRC enforcement action**, nor were they used as a basis for future enforcement actions. Audit team members evaluated departures based on their best professional judgment.

The SMZ law and rules were applicable to all 43 sites. Harvest of trees within riparian areas (not necessarily the SMZ) occurred on 28 of the 43 sites (Table 2). On six of the sites evaluated, four pre-approved alternative practices, as allowed under the SMZ Rules, and four DNRC-approved, site-specific alternative practices were utilized.

A total of six SMZ departures were noted on four of the 43 sites evaluated. These numbers represent an impressive improvement from the 2000 audit results (Table 12). A total of 405 SMZ evaluations were made. SMZ rules were applied correctly 99% of the time. Of the six departures, five had no impacts and one had a major impact.

Table 12
SMZ Departures by Ownership Group

Ownership Group	Number of Sites Evaluated		Number of Sites With Departures		Total Number of Departures	
	2000	2002	2000	2002	2000	2002
DNRC	5	5	1	0	1	0
Federal	9	5	4	0	7	0
Industrial	18	21	3	1	5	2
NIPF	10	12	3	3	4	4
All Sites	42	43	11	4	17	6

See Table 13 for the summary and comparison of SMZ departures by practice.

Table 13

SMZ Departures by Practice

Practice	# Departures
SMZ Width Maintained	1
Equipment Operation in SMZ	3
SMZ Maintained/Properly Marked	1
Side-casting into Stream	1
TOTAL	6

Table 14 provides information on the percentage of sites, for each ownership, upon which departures occurred.

Table 14

Ownership Distribution of Sites with SMZ Departures

Ownership	Total Number Sites	Number of Sites With Departures	% Owner Sites W/ Departures
DNRC	5	0	0%
Federal	5	0	0%
Industry	21	2	9%
NIPF	12	4	33%
Total	**43**	**6**	**14%**

SMZ effectiveness was very high, over 99% for all ownerships combined. Of the 410 SMZ evaluations, 409 provided adequate protection. The one impact observed was major.

SMZ Width

Although the BMP Audit form is not designed to provide highly specific results analysis regarding SMZ widths, there is information that can be presented.

With regards to SMZs requiring a minimum width of 100 feet (percent slope greater than 35%), the maximum width recorded was 150 feet, the minimum 75 feet and the average 118 feet.

For SMZs requiring a minimum width of 50 feet (percent slope less than 35%), the maximum width recorded was 88 feet, the minimum was 50 feet and the average 59 feet.

Results show that one audit site (2% of the total sites) received application departures for not maintaining the minimum SMZ width throughout the entire length of the SMZ evaluated. In that case the bench rule was improperly applied, resulting in an SMZ width of 75 feet where 100 feet was required. All SMZs had a minimum and average width of 50 feet or more.

DISCUSSION

Application Across All Ownerships

Ninety-six percent of the practices rated were properly applied according to BMP standards (Table 3). This percentage represents no change from 2000 and maintains the improvement over all audits prior to 2000 (Table 15). The high application compliance percentage demonstrates the strong commitment all ownership groups have to BMPs.

Effectiveness Across All Ownerships

Table 7 indicates that:

- Forty-two percent (18 out of 43) of the audit sites had no impacts recorded.
- Thirty-seven percent of the audited sites (16 out of 43) had minor/temporary impacts.
- Thirty-five percent (15 out of 43) had either major/temporary or minor/prolonged impacts.
- Two sites had one instance each where major/prolonged impacts occurred.
- An individual site can be counted in more than one category.

The most frequent departures and impacts were associated with road drainage. The following list ranks rated BMPs by the sum of departures and impacts. Practice III.C.1 is ranked #1 because it had more total departures and impacts than any other practice. An (--) indicates departures and impacts were not frequent enough to be in the top list for that year. Ties indicate BMPs with equal number of departures/impacts.

Practice #	BMP Description	2002	2000	1998	1996	1994	1992	1990
III. C. 1 *	Provide adequate road surface drainage for all roads	1	1	1	1	1	3	1
V. B. 1b	Direct road drainage away from stream crossing site.	2	2	5	3	3	13	19
III. C. 7 *	Route road drainage through adequate filtration zones before entering a stream	2	3	2	7	2	2	3
III. E. 2 *	Maintain erosion control features (dips, ditches and culverts functional).	3	6	3	5	5	--	10
V.D. 1	Existing Culverts	3			New BMP 2002			
III.C.3	Skew ditch relief culverts	4	4	8	10	--	--	--
III. D. 5	Cut and fill slopes at stable angle.	5	5	10	6	--	12	--
III.D.3	Effective sediment control on erodible fill slopes.	5	--	--	--	--	--	--
III. C. 5	Provide energy dissipaters at drainage structure outlets where needed.	6	7	4	14	11	--	--
III.C.4	Drainage culvert on grade or rock anchor or anchor down spouts.	6	-	4	14	11	--	--

* Indicates "High Risk" BMPs.

The top three BMPs on the above list account for 48% of all departures and impacts. It can also be seen from this listing that the top three for 2002 also rank toward the top of the list over all audit years.

The practices listed above accounted for 78% of all departures and 77% of all impacts. The 13 remaining BMPs where departures or impacts occurred had 3 or less departures plus impacts. Of 50 practices rated, 23 had zero departures or impacts. One high risk BMP, "Limit The Water Quality Impacts Or Prescribed Fire," did not receive any downgrades.

Combining application and effectiveness, the 2002 audits rated a total of 3,486 practices across all 43 audited sites. There were a combined a total of 133 ratings with a departure or impact. **A departure or an impact occurred on less than 4% of all practices rated.** See Appendix J for a ranked summary of all departures and impacts by BMP for the 2002 audits.

An interesting question concerns the effectiveness rating associated with an application departure. When a BMP received an application rating of 3 (minor departure from BMP), 42% of the time the corresponding effectiveness rating was 4 (adequate protection), 34% of the time the corresponding effectiveness rating was 3 (minor temporary impacts), and 24% of the time a 2 (major temporary or minor prolonged impacts). In all instances, when a BMP was rated a 2 for application, the effectiveness rating was 2 or less.

New BMPs Rated In 2002 Audits

The 2002 Audits rated two new BMPs (III.C.2 and V.D.1) and reinstated one existing but not previously rated BMP (IV.B.2). A summary of those results is contained in Table 15.

Table 15
Audit Results For BMPs New In 2002

BMP	# Rated Sites	# Of Departures	# Of Impacts
III.C.4	34	3	1
III.C.2	22	2	0
IV.B.2	16	0	0
V.D.1	22	7	4

Of the seven departures with V.D.1, three were the result of undersized pipes (n.b., BMP is for 25-year event – not fish passage). Three of the four impacts recorded resulted in sediment delivery to streams (Major impacts). New and reestablished BMPs accounted for 16 percent of the total number of departures and 9 percent of the total impacts.

Comparisons with Previous Audits

See Table 16 for a general comparison of audit results.

Even though two new BMPs were added in 2002 and two existing BMPs were rated for the first time, the 2002 audit results remain comparable to the 1990, 1992, 1994, 1996, 1998 and 2000 audits (see Impacts of New BMPs On Previous Years Comparisons discussion below). The

same selection criteria and rating format were used. Most 2002 audit team members participated in previous audits. Earlier audits, conducted in 1988 and 1989, were similar, but had differences in design, format and BMPs.

Table 16
Comparison of BMP Audit Results – 2002 with 2000, 1998, 1996, 1994, and 1992

Category	2002	2000	1998	1996	1994	1992	1990
Application of practices that meet or exceed BMP requirements.	96%	96%	94%	92%	91%	87%	78%
Application of high risk practices that meet or exceed BMP requirements.	90%	92%	84%	81%	79%	72%	53%
Number of sites with at least one major departure in BMP application.	10 of 43 (23%)	4 of 42 (10%)	8 of 47 (17%)	12 of 44 (27%)	17 of 46 (37%)	20 of 46 (43%)	27 of 44 (61%)
Average number of departures in BMP application, per site.	1.8	1.4	2	3	3.9	5.6	9
Percentage of practices providing adequate protection.	97%	98%	96%	94%	93%	90%	80%
Percentage of high risk practices providing adequate protection.	92%	93%	89%	86%	83%	77%	58%
Number of sites having at least one major/temporary or minor/prolonged impacts.	15 of 43 (35%)	9 of 42 (21%)	12 of 47 (26%)	15 of 44 (34%)	13 of 46 (28%)	17 of 46 (37%)	28 of 44 (64%)
Average number of impacts per site.	1.3	1	1.5	2.3	3	4.6	8

The 2002 results show a slight downturn in results when compared to previous years. Even when the effects of the new BMPs are removed, results still show the slight downwards movement. This slight downward movement is evident in both overall results and high risk BMPs. For a detailed comparison of results between 2000 and 2002 see Tables 17, 18, 19 and 20. **Bold** indicates where scores declined.

The most notable change in results between the 2000 and 2002 Audits is the increase in departures and impacts per audit site and the increase in the more severe departures and impacts. Several of these were related to the new BMPs – especially V.D.1: three major departures and three major impacts.

Table 17
Comparison 2000 vs. 2002
Application of BMPs All Rated Practices
by Ownership Group and Rating Category

Ownership Group	Number of Practices Rated		Percentage (%) Practices Rated As							
			Meet or Exceed		Minor Departures		Major Departures		Gross Neglect	
	2000	2002	2000	2002	2000	2002	2000	2002	2000	2002
DNRC	223	215	97%	98%	3%	2%	<1%	<1%	0%	0%
Federal	349	178	96%	**89%**	4%	**7%**	<1%	**4%**	0%	0%
Industrial	733	898	98%	98%	2%	2%	0%	**<1%**	0%	0%
NIPF	429	452	94%	94%	6%	6%	<1%	**2%**	0%	0%
All Sites	1,734	1,743	96%	96%	3%	3%	<1%	**1%**	0%	%0

Table 18
Comparison 2000 vs. 2002
Audit Sites with Application Departures and
Average Number of Departures per Site

Ownership Group	Total # of Sites		Percentage (%) of Sites w/out Departures		Percentage (%) of Sites With Departures						Average Number of Departures per Site*					
			Meet or Exceed		Minor		Major		Gross Neglect		Minor		Major		Gross Neglect	
	2000	2002	2000	002	2000	2002	2000	2002	2000	2002	2000	2002	2000	2002	2000	2002
DNRC	5	5	0%	60%	80%	60%	20%	0%	0%	0%	1.2	1.0	.2	0	0	0
Federal	9	5	11%	**0%**	78%	**80%**	11%	**80%**	0%	0%	1.4	**2.4**	.11	**1.6**	0	0
Industrial	18	21	50%	**48%**	50%	**52%**	0%	**4%**	0%	0%	.78	.7	0	**.05**	0	0
NIPF	10	12	10%	**8%**	80%	75%	20%	**42%**	0%	0%	2.4	2.2	.3	**1.5**	0	0
All Sites	42	43	26%	**33%**	62%	60%	10%	**23%**	0%	%0	1.3	**1.4**	.12	**.39**	0	0

Table 19
Comparison 2000 vs. 2002
Effectiveness of BMPs for All Rated Practices
by Ownership Group and Rating Category

Ownership Group	Number of Practices Rated		Percentage (%) Practices Rated As							
			Adequate Protection		Minor/Temp. Impacts		Major/Temp., Minor/ Prolonged		Major/ Prolonged	
	2000	2002	2000	2002	2000	2002	2000	2002	2000	2002
DNRC	223	215	98%	99%	2%	1%	<1%	0%	0%	0%
Federal	349	178	97%	**89%**	1%	**4%**	1%	**7%**	0%	0%
Industrial	733	898	99%	99%	<1%	<1%	<1%	<1%	0%	0%
NIPF	429	452	95%	95%	4%	2%	1%	**3%**	0%	**<1%**
All Sites	1,734	1,743	98%	**97%**	2%	1%	<1%	**2%**	0%	**<1%**

Table 20
Comparison 2000 vs. 2002
Audit Sites with Impacts and
Average Number of Impacts per Site

Ownership Group	Total # of Sites		Percentage (%) of Sites w/out Impacts		Percentage (%) of Sites With Impacts						Average Number of Impacts per Site*					
			Adequate or Improved Protection		Minor/ Temp.		Major/Temp., Minor/ Prolonged		Major/ Prolonged		Minor/ Temp.		Major/Temp. Minor/ Prolonged		Major/ Prolonged	
	2000	2002	2000	2002	2000	2002	2000	2002	2000	2002	2000	2002	2000	2002	2000	2002
DNRC	5	5	40%	40%	60%	40%	20%	0%	0%	0%	.8	.6	.2	0	0	0
Federal	9	5	44%	**0%**	33%	**60%**	33%	**100%**	0%	0%	.56	**1.4**	.44	**2.6**	0	0
Industrial	18	21	61%	**57%**	33%	29%	6%	6%	0%	0%	.33	.33	.06	**.24**	0	0
NIPF	10	12	10%	**33%**	80%	33%	40%	40%	0%	**17%**	1.5	.67	.6	**1.0**	0	**.17**
All Sites	42	43	43%	**42%**	48%	37%	21%	**35%**	0%	**4%**	.71	.58	.29	**.70**	0	**.05**

Results by Ownership Group

Ownership groups varied in their comparisons to 2000 Audit results.

DNRC results remained the same or made slight improvements when compared to 2000 results.

Industry results varied between slight improvements and slight reductions depending on the categories observed. The percentage of sites with no departures and the percentage of sites with no impacts were down by a few percentage points, and the number of major impacts per site up by .18 per site. These numbers are so small as to be of little significance. Industry results remained essentially unchanged from 2000.

Overall NIPF percentages for Application and Effectiveness remained unchanged from 2000 results. Percentage of sites with major departures and impacts increased from 2000 as did the number of major departures and impacts per site. Two NIPF sites had major and prolonged impacts.

The Federal scores dropped below 90% for both application and effectiveness for the first time since the 1994 Audits. The 89% Application and Effectiveness ratings represent decreases in overall percentages of seven and eight percent respectively. Percentages and numbers for major departures and impacts also increased.

When considering improvements and reductions, it is appropriate to note changes from the previous audit. In evaluating the 2002 Audit results, because of the small sample size a relatively few downward changes can result in proportionally large downward movement of percentages. No conclusions regarding an ownership's commitment to BMPs or technical expertise should be made based on data from a single year's audit results. Audit results should be assessed in terms of trends. The 2002 results show a downward movement from previous results. This information should next be compared with the results of the 2004 audits to determine if a shift in the trend of audit results is occurring.

For the purpose of long-term comparison, Table 21 displays summarized audit results for years 1990, 1992, 1994, 1996, 1998, 2000 and 2002.

Table 21
Summarized Audit Results 1990 Through 2002

		1990	1992	1994	1996	1998	2000	2002
Application								
	Meets/Exceeds	78%	87%	91%	92%	94%	96%	96%
	Minor Departures	14%	8%	7%	7%	5%	3%	3%
	Major Departures	8%	4%	3%	1%	1%	0.3%	1%
Effectiveness	Adequate Protection	80%	90%	93%	94%	96%	98%	97%
	Minor Impacts	11%	6%	5%	4%	3%	2%	1%
	Major Impacts	8%	4%	2%	2%	1%	.07%	2%
% Sites	With Major Departures	61%	43%	37%	27%	17%	10%	23%
	With Major Impacts	64%	37%	28%	34%	26%	21%	35%
Departures	Minor Per Site	5.5	3.7	2.7	2.5	1.7	1.3	1.4
	Major Per Site	2.5	1.4	1.1	0.55	0.34	0.12	0.39
Impacts	Minor Per Site	4.4	2.8	2.1	1.6	1	0.71	0.58
	Major Per Site	3.0	1.4	0.8	0.66	0.51	0.29	0.7

Impacts of New BMPs On Previous Years' Comparisons

Between the 2000 and 2002 Audits the BMP Technical Committee added two new BMPs and reestablished two existing BMPs as audited BMPs. The new BMPs are (Appendix A) III.C.2 ephemeral draw culverts and V.D.1 existing stream crossing culverts. The reestablished audited BMPs are IV.B.2 avoid equipment operation in isolated wetlands and III.C.4 install culverts at the gradient of the original ground slope. How would the addition of these BMPs affect comparisons of 2002 of results with previous audit results?

Table 22 displays 2002 Audit results both with and without the new BMPs. For additional comparison, the results of the 2000 Audits are also presented.

Rated Practices Percentages remained essentially unchanged from 2000 with and without the incorporation of the new BMPs into the results. 2002 Audit Site Data showed small overall rating declines. This would be expected, as between the two new BMPs there were a total of 9 application departures and 4 effectiveness impacts. The ratings for III.C.4 showed a total of 3 minor departures with one minor and temporary impact; IV.B.2 ratings were 4/4 on all 43 sites. These numbers are not enough to changes the rating percentages but would slightly affect the per site numbers. Removing the new BMPs also does not alter the general comparison of results with the 2000 and previous audits. In Rated Practices Results, application percentage remained unchanged and effectiveness decreased by one percent. In Audit Site Data results the overall increase in major impacts remains.

Table 22
Ratings Comparisons With and Without New BMPs

						Audit Site Data						
	Rated Practices Percentages					% Sites With Impacts				Ave. Impacts/Site		
Application	# Practices Rated	4/5	3	2	1	4/5	3	2	1	3	2	1
2002 W New	1,743	96	3	1	0	33	60	23	0	1.4	.39	0
2002W/O New	1,650	96	3	1	0	37	58	21	0	1.2	.32	0
2000	1,734	96	3	1	0	26	62	10	0	1.3	.12	0
Effectiveness												
2002 W New	1,743	97	1	2	1	42	37	35	4	.58	.7	.04
2002W/O New	1,650	97	1	2	1	44	35	35	2	.54	.65	.02
2000	1,734	98	2	1	0	43	48	21	0	.71	.29	0

Again, with regards to improvements and reductions, it is appropriate to note changes from previous audits. Because of the relatively small sample size a few upward or downward changes can result in proportionally large upward or downward movement of percentages and numbers. No conclusions regarding application or effectiveness trends or landowner commitment to BMPs should be made based on data from a single year's audit results.

Third Party Road And Grazing Implications

Audit team members noted a range of water quality impacts not resulting directly from the audited timber sale. Both grazing and third-party road impacts were observed at several audit sites. **Grazing** was noted as being especially significant in impacting water quality. Teams noted that in at least one case, grazing impacts in a stream channel created difficulties in rating the applicable BMPs. It was difficult to tell if the BMP was adequately applied because grazing impacts had removed the evidence indicating the level of original application. **Third-party roads** are roads not owned or directly controlled by the audited party. Because the roads are not under the direct control of the audited landowner, third-party roads are not rated in the audit process. In order to qualitatively monitor BMPs associated with third-party roads, there is a location in section VII of the audit form Appendix G) where audit teams can record observations regarding third-party roads. Several situations were noted where impacts were occurring because either roads were not adequately maintained by the road owner or roads were being used for another purpose, and that non-audit activity was causing impacts. Of the 43 sites audited, 22 involved third-party roads. Of the 22, twelve third-party roads had BMP departures noted. Of the 12, three (two county and one BLM road) had departures that resulted in direct delivery to streams.

Reductions In Overall Sediment Delivery

Following the 1998 BMP audits, several members of the BMP Audit Technical Working Group (TWG) expressed a concern regarding the policy regarding awarding "5" ratings for BMP Effectiveness (see page 9, Rating Form). They believed the current policy may result in obscuring recognition of actual reductions in sediment delivery to streams when compared to pre-project conditions, and that these reductions in sediment are the result of improved protection to soil and water resources due to adequately applying BMPs.

As detailed in the discussion of the Rating Form beginning on page 9, a "5" for Effectiveness is defined as "Improved protection of soil and water resources over pre-project conditions." Thus, if a BMP is applied adequately and its application leads to improved protection over pre-project conditions, the effectiveness rating for that practice would be a "5." In actuality the audit rating policy does not exactly follow the Effectiveness "5" definition. At some point during audit history it was decided that if a BMP practice was applied such that the requirements of the BMP were met, this would provide adequate protection and thus receive an effectiveness rating of "4." Effectiveness ratings of "5" are in fact only given if the protection provided is extraordinary or more than adequate; for example, installing a bridge for fish passage when a CMP would have met the BMP requirement. It was pointed out that due to this rating policy, there may be and probably are projects where application of BMPs has brought on-the-ground conditions up to BMP standards and is resulting in reductions in sediment delivery over pre-project conditions due to improved protection. If this improvement is occurring, the rating policy is obscuring this improvement. The question was asked as to how this could be evaluated and the results presented in the Audit Report.

The TWG decided to add a new question to the BMP Audit Form (Appendix G). This new Yes/No question is found in Section VII of the Audit Form and reads, "Project included road improvements to existing road system that reduced overall sediment delivery to streams." The teams were asked to do a visual qualitative assessment of each audited project's post-project road system and, when possible, determine if improvements resulted in a reduction in sediment delivery to streams. The 2002 audit results for this question are provided in Table 23.

Table 23
Overall Sediment Reduction Over Pre-Project Condition

Landowner	# Sites Audited	# Sites Applicable	Number Yes	Number No
DNRC	5	5	5	0
FEDERAL	5	4	2	2
INDUSTRY	21	19	18	1
NIPF	12	11	8	3
TOTALS	43	39	33	5

Results indicate that at 85% of the applicable audit sites, sediment delivery to streams from existing roads has been reduced over pre-project conditions

Existing roads are defined as road systems in place prior to commencement of activities on the audited project. This question did not apply to project areas unroaded prior to commencement of activities on the audited project.

It should be noted that a "Yes" determination does not necessarily mean that there is no sediment delivery occurring post-project. A "Yes" indicates that the current status regarding delivery is improved over pre-project conditions. A "No" determination does not mean that conditions have worsened, nor that no improvements were made to the existing road system. A "No" indicates that any improvements made did not lead to reductions over pre-project conditions.

CONCLUSIONS

This final section will provide concluding remarks. The remarks will focus on addressing the objectives of the Best Management Practices audits as outlined on page 5.

Determine if BMPs are being applied on timber harvest operations.

With regards to the sites audited, it can be conclusively stated that audited BMPs are being applied and applied correctly at a very high rate. There were no sites audited where evidence of BMP application was not present. Although the 2002 Audit results showed a slight increase in major departures in application, across the state BMPs are well established as the Montana forestry standard for timber harvest practices. Although the sites selected represent only sites meeting specific criteria (page 7), it is believed by the author (DNRC) that the conclusions based on sites audited can be extended to the non-sample population, especially if there is water associated with the project.

Evaluate the general effectiveness of BMPs in protecting soil and water resources.

Conclusions drawn from audit results over the past 12 years are very consistent and straightforward; when BMPs are applied correctly, they are very effective in the protection of soil and water resources.

Provide information on the implementation of the SMZ law and rules and evaluate the general effectiveness of SMZs in protecting water quality.

The 2002 audit data continues to show that the SMZ law and rules are being applied across the state. These results are consistent with DNRC's enforcement program. DNRC enforcement records show that the number of law and rule violations across the state are generally few and that the impacts associated with these violations are generally minor and easily repairable. The 2002 audit data continues to support the contention that SMZ law and rules are effective in protecting water quality with regards to the prohibited practices.

Provide information to focus future educational or study efforts by identifying subjects and geographic areas in need of further attention or investigation.

A list of top priority issues or subject areas and recommendations for education and information are as follows.

- Fisheries Issues and TMDLs--Discern and educate regarding the proper technical applications and criteria to evaluate fish in relation to water quality.

- Work with Conservation Districts, county road maintenance programs and other water quality-related parties to communicate the big picture of BMPs and how we can interact for the improvement of water quality.

- Continue education and information sharing on road surface drainage issues. They continue to be the source of the majority of BMP departures.

- Consider ways to reach more woods workers and especially NIPF landowners regarding BMPs and SMZs.

- Consider informational presentations of the SMZ law and rules and BMPs and the BMP process in university classes.

- Continue the relationship and educational efforts of DNRC and MLA in the BMP and SMZ workshops for woods workers. Consider trying to enlarge its sphere of influence in consideration of the previous bullet.

- Continue to work with audit team members in meeting their needs for information and clarification of audit issues, and continue to present that information during the audit calibration audits.

Provide information on the need to revise, clarify or strengthen BMPs.

Audit team leaders and team members met on September 26, 2002 to discuss the 2002 field audits and the audit process in general. Team members who could not attend were invited to submit verbal or written comments. The September 26th meeting resulted in a list of concerns, requests and recommendations for the BMP Audit Technical Working Group to respond to. The BMP Technical Working Group (TWG) will meet in late 2002 or early 2003 to consider the concerns and recommendations generated by the audit team members.

What follows is a summary of the recommendations and requests submitted by audit team members to the TWG. For a complete text of either meeting's minutes, contact the Montana Department of Natural Resources and Conservation, Service Forestry Bureau, in Missoula, MT.

It is recommended that BMP Audits be continued and the next audits occur in the year 2004.

- Some BMPs rate a single practice at multiple locations, drainage, landings, culverts and then one rating to encompass all. One bad dip gets the departure, when there might be 5 miles of road have good dips.

- Need to review BMPs regarding fords. More often fords are being recommended and used.

- There is a site selection problem with NIPF landowners where there is a land use change from timber to subdivision and how roads change.

- Rating road maintenance several years after harvest completed. Interim use or other road use cause impacts, not harvest.

- Review impacts of larger slash piles to soil resources next to stream courses.

- Review the new existing culverts BMP. This BMP takes the decision-making out of the hands of the landowner as to changing the pipe.

- Need to address post-wildfire audits.

- Must continue efforts to address fish passage.

- Number of site selection options for Federal ownerships. The pool of sites gets smaller and smaller over time. Fewer have streams.

- Keep BLM and the University System in the mix.

- Work with BIA and try to get them to get involved.

- Currently alternative practices and 310 permits are a check "yes" or "no" question on the audit form. Should we add a rating that asks if the special criteria was adequately applied and effective?

- Review the number of audits per team/ownership group and total number of sites audited.

References

Ehinger W. and D. Potts. 1990. On-site Assessment of "Best Management Practices as an Indicator of Cumulative Watershed Effects in the Flathead Basin." Flathead Basin Water Quality and Fisheries Cooperative. University of Montana School of Forestry. Missoula, Montana 137 pp.

Ethridge R. and P. Heffernan. 2000. Montana Forestry Best Management Practices Monitoring—The 2000 Forestry BMP Audits Report. Montana Department of Natural Resources and Conservation, Forestry Division, Missoula, MT. 69 pages

Frank, Gary. 1994. Montana Forestry Best Management Practices Implementation Monitoring--The 1994 Forestry BMP Audits Final Report. Montana Department of State Lands, Forestry Division, Missoula, MT. 30pp.

Fortunate, Norman, et. al., 1998, Montana Best Management Practices Monitoring 1998 Forestry BMP Audit Report. Montana Department of Natural Resources and Conservation, Forestry Division, Missoula, MT. 62 pp.

Idaho Dept. of Health and Welfare. 1989, Final Report: Forest Practices Water Quality Audit 1988. Idaho DHW, Division of Environmental Quality. Boise, Idaho, 26 pp.

Mathieus, George. 1996. Montana Forestry Best Management Practices Implementation Monitoring--The 1996 Forestry BMP Audits Final Report. Montana Department of Natural Resources and Conservation, Forestry Division, Missoula, MT. 35 pp.

Montana Dept. of Health and Environmental Sciences. 1990. Montana Water Quality, 1990. Montana DHES, Water Quality Bureau. Helena, MT. 21 pp.

National Council of the Paper Industry for Air and Stream Improvement (NCASI). 1988. Procedures for Assessing the Effectiveness of Best Management Practices in Protecting Water and Stream Quality Associated with Managed Forests. NCASI Technical Bulletin 538. January, 1988. 23 pp.

Schultz, Bill. 1990. Montana Forestry Best Management Practices Implementation Monitoring--The 1990 Forestry BMP Audits Final Report. Montana Department of State Lands, Forestry Division, Missoula, MT. 32p.

Schultz, Bill. 1992. Montana Forestry Best Management Practices Implementation Monitoring--The 1992 Forestry BMP Audits Final Report. Montana Department of State Lands, Forestry Division, Missoula, MT. 32p.

Zackheim, Hugh. 1988. House Joint Resolution 49--Forest Practices and Watershed Effects: Final Report. Montana Environmental Quality Council. Helena, MT. 95 pp.

APPENDIX A

BEST MANAGEMENT PRACTICES FOR FORESTRY IN MONTANA
January 2002

* BMPs Not Monitored During Audits
# BMPs Edited in 2002

I. DEFINITIONS

1. "Hazardous or toxic material" means substances which by their nature are dangerous to handle or dispose of, or a potential environmental contaminant, and includes petroleum products, pesticides, herbicides, chemicals, and biological wastes.

2. "Stream," as defined in 77-5-302(7), MCA, means a natural water course of perceptible extent that has a generally sandy or rocky bottom or definite banks and that confines and conducts continuously or intermittently flowing water.

3. "Streamside Management Zone (SMZ)" or "zone" as defined at 77-5-302(8), MCA means "the stream, lake, or other body of water and an adjacent area of varying width where management practices that might affect wildlife habitat or water quality, fish, or other aquatic resources need to be modified." The streamside management zone encompasses a strip at least 50 feet wide on each side of a stream, lake, or other body of water, measured from the ordinary high water mark, and extends beyond the high water mark to include wetlands and areas that provide additional protection in zones with steep slopes or erosive soils.

4. "Wetlands" mean those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include marshes, swamps, bogs, and similar areas.

5. Adjacent wetlands are wetlands within or adjoining the SMZ boundary. They are regulated under the SMZ law.

6. Isolated wetlands lie within the area of operation, outside of the SMZ boundary, and are not regulated under the SMZ law.

II. STREAMSIDE MANAGEMENT

The Streamside Management Law (77-5-301 through 307 MCA) provides minimum regulatory standards for forest practices in streamside management zones (SMZ). The "Montana Guide to the Streamside Management Zone & Rules" is an excellent information source describing management opportunities and limitations within SMZs.

III. ROADS

A. <u>Planning and Location</u>

1. Minimize the number of roads constructed in a watershed through comprehensive road planning, recognizing intermingled ownership and foreseeable future uses. Use existing roads, unless use of such roads would cause or aggravate an erosion problem.

2. Review available information and consult with professionals as necessary to help identify erodible soils and unstable areas, and to locate appropriate road surface materials.*

3. Fit the road to the topography by locating roads on natural benches and following natural contours. Avoid long, steep road grades and narrow canyons.

4. Locate roads on stable geology, including well-drained soils and rock formations that tend to dip into the slope. Avoid slumps and slide-prone areas characterized by steep

slopes, highly weathered bedrock, clay beds, concave slopes, hummocky topography, and rock layers that dip parallel to the slope. Avoid wet areas, including moisture-laden or unstable toe slopes, seeps, wetlands, wet meadows, and natural drainage channels.

5. Minimize the number of stream crossings and choose stable stream crossing sites.

6. Locate roads to provide access to suitable (relatively flat and well-drained) log landing areas to reduce soil disturbance.*

B. Design

1. Properly design roads and drainage facilities to prevent potential water quality problems from road construction.*

2. Design roads to the minimum standard necessary to accommodate anticipated use and equipment. The need for higher engineering standards can be alleviated through proper road-use management.

3. Design roads to balance cuts and fills or use full bench construction (no fill slope) where stable fill construction is not possible.*

4. Design roads to minimize disruption of natural drainage patterns. Vary road grades to reduce concentrated flow in road drainage ditches, culverts, and on fill slopes and road surfaces.

C. Road Drainage

Road Drainage ***Road Drainage is defined as all applied mechanisms for managing water in a non-stream crossing setting, road surface drainage, and overland flow; ditch relief, cross drains and drain dips) #***

1. Provide adequate drainage from the surface of all permanent and temporary roads. Use outsloped, insloped or crowned roads, and install proper drainage features. Space road drainage features so peak flow on road surfaces or in ditches will not exceed capacity.

   a. Outsloped roads provide a means of dispersing water in a low-energy flow from the road surface. Outsloped roads are appropriate when fill slopes are stable, drainage will not flow directly into stream channels, and transportation safety can be met.

   b. For in-sloped roads, plan ditch gradients steep enough, generally greater than 2% but less than 8%, to prevent sediment deposition and ditch erosion. The steeper gradients may be suitable for more stable soils; use the lower gradients for less stable soils.

   c. Design and install road surface drainage features at adequate spacing to control erosion; steeper gradients require more frequent drainage features. Properly constructed drain dips can be an economical method of road surface drainage. Construct drain dips deep enough into the subgrade so that traffic will not obliterate them.

2. Design all ephemeral draw culverts with adequate length to allow for road fill width. Minimum culvert size is 15 inch. Install culverts to prevent erosion of fill, seepage and failure as described in V.C.4 and maintain cover for culverts as described in V.C.6. #

3. Design all relief culverts with adequate length to allow for road fill width. Protect the inflow end of all relief culverts from plugging and armor if in erodible soil. When necessary construct catch basins with stable side slopes. Unless water flows from two

directions, skew ditch relief culverts 20 to 30 degrees toward the inflow from the ditch to help maintain proper function. #

4. Where possible, install culverts at the gradient of the original ground slope; otherwise, armor outlets with rock or anchor downspouts to carry water safely across the fill slope.

5. Provide energy dissipaters (rock piles, slash, log chunks, etc.) where necessary to reduce erosion at outlet of drainage features. Crossdrains, culverts, water bars, dips, and other drainage structures should not discharge onto erodible soils or fill slopes without outfall protection.

6. Prevent downslope movement of sediment by using sediment catch basins, drop inlets, changes in road grade, headwalls, or recessed cut slopes.*

7. Route road drainage through adequate filtration zones or other sediment-settling structures to ensure sediment doesn't reach surface water. Install road drainage features above stream crossings to route discharge into filtration zones before entering a stream.

D. **Construction** (see also Section IV on stream crossings)

1. Keep slope stabilization, erosion and sediment control work current with road construction. Install drainage features as part of the construction process, ensuring that drainage structures are fully functional. Complete or stabilize road sections within same operating season.*

2. Stabilize erodible, exposed soils by seeding, compacting, riprapping, benching, mulching, or other suitable means.

3. At the toe of potentially erodible fill slopes, particularly near stream channels, pile slash in a row parallel to the road to trap sediment (example, slash filter windrow). When done concurrently with road construction, this is one method that can effectively control sediment movement, and it can also provide an economical way of disposing of roadway slash. Limit the height, width and length of "slash filter windrows" so wildlife movement is not impeded. Sediment fabric fences or other methods may be used if effective.

4. Minimize earthmoving activities when soils appear excessively wet. Do not disturb roadside vegetation more than necessary to maintain slope stability and to serve traffic needs.*

5. Construct cut and fill slopes at stable angles to prevent sloughing and other subsequent erosion.

6. Avoid incorporating potentially unstable woody debris in the fill portion of the road prism. Where possible, leave existing rooted trees or shrubs at the toe of the fill slope to stabilize the fill.

7. Consider road surfacing to minimize erosion.*

8. Place debris, overburden, and other waste materials associated with construction and maintenance activities in a location to avoid entry into streams. Include these waste areas in soil stabilization planning for the road.

9. Minimize sediment production from borrow pits and gravel sources through proper location, development and reclamation.

10. When using existing roads, reconstruct only to the extent necessary to provide adequate drainage and safety; avoid disturbing stable road surfaces. Prior to reconstruction of existing roads within the SMZ, refer to the SMZ law. Consider abandoning existing roads when their use would aggravate erosion.

E. Maintenance

1. Grade road surfaces only as often as necessary to maintain a stable running surface and adequate surface drainage.

2. Maintain erosion control features through periodic inspection and maintenance, including cleaning dips and crossdrains, repairing ditches, marking culvert inlets to aid in location, and clearing debris from culverts.

3. Avoid cutting the toe of cut slopes when grading roads, pulling ditches, or plowing snow.

4. When plowing snow, provide breaks in snow berm to allow road drainage.*

5. Haul all excess material removed by maintenance operations to safe disposal sites and stabilize these sites to prevent erosion. Avoid sidecasting in locations where erosion will carry materials into a stream.*

6. Avoid using roads during wet periods if such use would likely damage the road drainage features. Consider gates, barricades or signs to limit use of roads during spring break up or other wet periods.

7. Upon completion of seasonal operations, ensure that drainage features are fully functional. The road surface should be crowned, outsloped, insloped, or water-barred. Remove berms from the outside edge where runoff is channeled.*

8. Leave abandoned roads in a condition that provides adequate drainage without further maintenance. Close these roads to traffic; reseed and/or scarify; and, if necessary, recontour and provide water bars or drain dips.

IV. TIMBER HARVESTING, AND SITE PREPARATION

A. Harvest Design

1. Plan timber harvest in consideration of your management objectives and the following*:

   a. Soils and erosion hazard identification.
   b. Rainfall.
   c. Topography.
   d. Silvicultural objectives.
   e. Critical components (aspect, water courses, landform, etc.).
   f. Habitat types.
   g. Potential effects on water quality and beneficial water uses.
   h. Watershed condition and cumulative effects of multiple timber management activities on water yield and sediment production.
   i. Wildlife habitat.

2. Use the logging system that best fits the topography, soil type, and season, while minimizing soil disturbance and economically accomplishing silvicultural objectives.

3. Use the economically feasible yarding system that will minimize road densities.*

4. Design and locate skid trails and skidding operations to minimize soil disturbance. Using designated skid trails is one means of limiting site disturbance and soil compaction. Consider the potential for erosion and possible alternative yarding systems prior to planning tractor skidding on steep or unstable slopes.*

5. Locate skid trails to avoid concentrating runoff and provide breaks in grade. Locate skid trails and landings away from natural drainage systems and divert runoff to stable areas. Limit the grade of constructed skid trails on geologically unstable, saturated, highly

erosive, or easily compacted soils to a maximum of 30%. Use mitigating measures, such as water bars and grass seeding, to reduce erosion on skid trails.

6. Minimize the size and number of landings to accommodate safe, economical operation. Avoid locating landings that require skidding across drainage bottoms.

B. Other Harvesting Activities

1. Tractor skid where compaction, displacement, and erosion will be minimized. Avoid tractor or wheeled skidding on unstable, wet, or easily compacted soils and on slopes that exceed 40% unless operation can be conducted without causing excessive erosion. Avoid skidding with the blade lowered. Suspend leading ends of logs during skidding whenever possible.

2. Avoid operation of wheeled or tracked equipment within isolated wetlands, except when the ground is frozen (see Section VI on winter logging).

3. Use directional felling or alternative skidding systems for harvest operations in isolated wetlands.*

4. For each landing, provide and maintain a drainage system to control the dispersal of water and to prevent sediment from entering streams.

5. Insure adequate drainage on skid trails to prevent erosion. On gentle slopes with slight disturbance, a light ground cover of slash, mulch or seed may be sufficient. Appropriate spacing between water bars is dependent on the soil type and slope of the skid trails. Timely implementation is important.

6. When existing vegetation is inadequate to prevent accelerated erosion, apply seed or construct water bars before the next growing season on skid trails, landings and fire trails. A light ground cover of slash or mulch will retard erosion.*

C. Slash Treatment and Site Preparation

1. Rapid reforestation of harvested areas is encouraged to reestablish protective vegetation.*

2. When treating slash, care should be taken to preserve the surface soil horizon by using appropriate techniques and equipment. Avoid use of dozers with angle blades.

3. Minimize or eliminate elongated exposure of soils up and down the slope during mechanical scarification.*

4. Scarify the soil only to the extent necessary to meet the resource management objectives. Some slash and small brush should be left to slow surface runoff, return soil nutrients, and provide shade for seedlings.

5. Carry out brush piling and scarification when soils are frozen or dry enough to minimize compaction and displacement.

6. Carry out scarification on steep slopes in a manner that minimizes erosion. Broadcast burning and/or herbicide application is preferred means for site preparation, especially on slopes greater than 40%.

7. Remove all logging machinery debris to proper disposal site.*

8. Limit water quality impacts of prescribed fire by constructing water bars in firelines; not placing slash in drainage features and avoiding intense fires unless needed to meet silvicultural goals. Avoid slash piles in the SMZ when using existing roads for landings.

V. STREAM CROSSINGS

A. Legal Requirements

1. Under the Natural Streambed and Land Preservation Act of 1975 (the "310 law"), any activity that would result in physical alteration or modification of a perennial stream, its bed or immediate banks must be approved in advance by the supervisors of the local conservation district. Permanent or temporary stream crossing structures, fords, riprapping or other bank stabilization measures, and culvert installations on perennial streams are some of the forestry-related projects subject to 310 permits.

   Before beginning such a project, the operator must submit a permit application to the conservation district indicating the location, description, and project plans. The evaluation generally includes on-site review, and the permitting process may take up to 60 days.

2. Stream-crossing projects initiated by federal, state or local agencies are subject to approval under the "124 permit" process (administered by the Department of Fish, Wildlife and Parks), rather than the 310 permit.

3. A short-term exemption (3a authorization) from water quality standards is necessary unless waived by the Department of Fish, Wildlife and Parks as a condition of a 310 or 124 permit. Contact the Department of Environmental Quality in Helena at 444-2406 for additional information.

B. Design Considerations (Note: 310 permit required for perennial streams)

1. Cross streams at right angles to the main channel if practical. Adjust the road grade to avoid the concentration of road drainage to stream crossings. Direct drainage flows away from the stream crossing site or into an adequate filter.

2. Avoid unimproved stream crossings. When a culvert or bridge is not feasible, locate drive-throughs on a stable, rocky portion of the stream channel.

C. Installation of Stream Crossings (Note: 310 permit required for perennial streams)

1. Minimize stream channel disturbances and related sediment problems during construction of road and installation of stream crossing structures. Do not place erodible material into stream channels. Remove stockpiled material from high water zones. Locate temporary construction bypass roads in locations where the stream course will have minimal disturbance. Time construction activities to protect fisheries and water quality.

2. When using culverts to cross small streams, install those culverts to conform to the natural stream bed and slope on all perennial streams and on intermittent streams that support fish or that provides seasonal fish passage. Ensure fish movement is not impeded. Place culverts slightly below normal stream grade to avoid culvert outfall barriers. Do not alter stream channels upstream from culverts, unless necessary to protect fill or to prevent culvert blockage.

3. Design stream-crossings for adequate passage of fish (if present), minimum impact on water quality, and at a minimum, the 25-year frequency runoff. Consider oversized pipe when debris loading may pose problems. Ensure sizing provides adequate length to allow for depth of road fill. #

4. Install stream-crossing culverts to prevent erosion of fill. Compact the fill material to prevent seepage and failure. Armor the inlet and/or outlet with rock or other suitable material where feasible.#

5. Consider dewatering stream crossing sites during culvert installation.*

6. Maintain a 1-foot minimum cover for stream-crossing culverts 15 to 36 inches in diameter, and a cover of one-third diameter for larger culverts, to prevent crushing by traffic.

7. Use culverts with a minimum diameter of 15 inches for permanent stream crossings.*

D. Existing Stream Crossing

1. Existing stream crossing culverts shall have adequate length to allow for road fill width and have adequate capacity to allow for the passage of the 25-year frequency runoff. To prevent erosion of fill, provide or maintain armoring at inlet and/or outlet with rock or other suitable material where feasible. Maintain fill over culvert as described in V.C. 6.

VI. Winter Logging

A. General

1. Consider snow-road construction and winter harvesting in isolated wetlands and other areas with high water tables or soil erosion and compaction hazards.*

2. Conduct winter logging operations when the ground is frozen or snow cover is adequate (generally more than one foot) to prevent rutting or displacement of soil. Be prepared to suspend operations if conditions change rapidly, and when the erosion hazard becomes high.*

3. Consult with operators experienced in winter logging techniques.*

B. Road Construction and Harvesting Considerations

1. For road systems across areas of poor bearing capacity, consider hauling only during frozen periods. During cold weather, plow any snow cover off of the roadway to facilitate deep freezing of the road grade prior to hauling.*

2. Before logging, mark existing culvert locations. During and after logging, make sure that all culverts and ditches are open and functional.*

3. Use compacted snow for road beds in unroaded, wet or sensitive sites. Construct snow roads for single-entry harvests or for temporary roads.*

4. In wet, unfrozen soil areas, use tractors or skidders to compact the snow for skid road locations only when adequate snow depth exists. Avoid steeper areas where frozen skid trails may be subject to erosion the next spring.*

5. Return the following summer and build erosion barriers on any trails that are steep enough to erode.*

VII. HAZARDOUS SUBSTANCES

A. General

1. Know and comply with regulations governing the storage, handling, application (including licensing of applicators), and disposal of hazardous substances. Follow all label instructions.

2. Develop a contingency plan for hazardous substance spills, including cleanup procedures and notification of the State Department of Environmental Quality.*

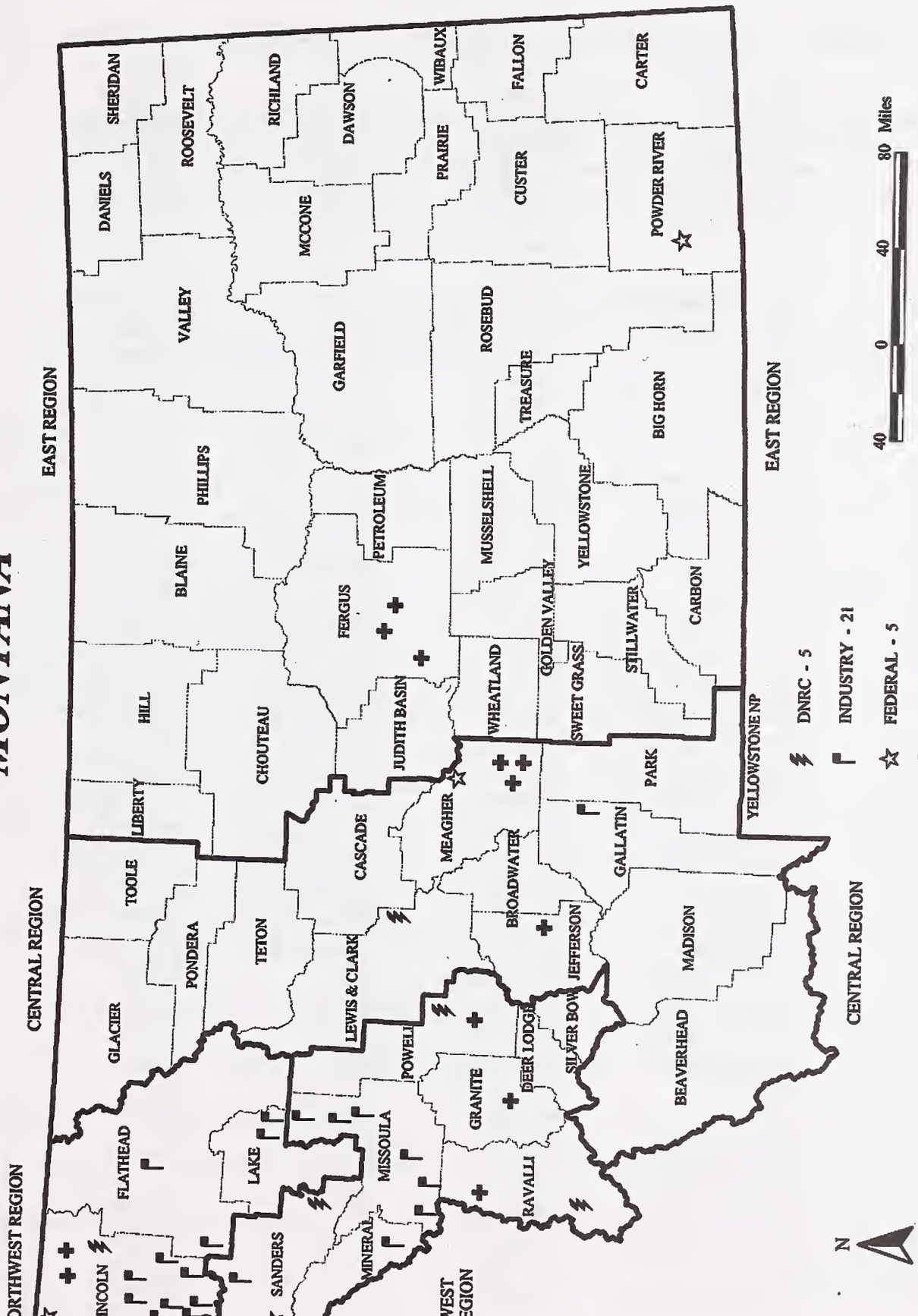
B. Pesticides and Herbicides

1. Use an integrated approach to weed and pest control, including manual, biological, mechanical, preventive and chemical means.*

2. To enhance effectiveness and prevent transport into streams, apply chemicals during appropriate weather conditions (generally calm and dry) and during the optimum time for control of the target pest or weed.*

APPENDIX B

2000 BMP AUDIT SITE LOCATION MAP



APPENDIX C

2002 BMP FIELD AUDITS
SITES PICKED FOR AUDITS BY OWNERSHIP GROUP

SITE NUMBER	SALE NAME	COUNTY	OWNER	TEAM
FED-1	Lyon Creek	Powder River	USFS	East
FED-3	Chipmunk	Sanders	USFS	West
FED-4	Pine	Lincoln	USFS	Northwest
FED-5	Wood Rat	Lincoln	USFS	Northwest
FED-6	Corridor Units	Meagher	USFS	East
DNRC-1	Selow Creek	Sanders	DNRC	West
DNRC-2	McKay Creek	Powell	DNRC	Central
DNRC-3	Lyman	Ravalli	DNRC	West
DNRC-5	Stewart Butcher	Lincoln	DNRC	Northwest
DNRC-6	Whitetail Prairie	Lewis & Clark	DNRC	Central
IND-1	BRE-34	Gallatin	R-Y Timber	Central
IND-2	Haskill 5 & 8 Pulp	Flathead	Stoltze	Northwest
IND-3	Mad Tom	Mineral	Plum Creek	West
IND-4	Lost 39	Missoula	Plum Creek	West
IND-5	Gold-N-Twin Tract	Missoula	Plum Creek	West
IND-6	Upper Chuck	Missoula	Plum Creek	West
IND-7	Dam Beaver	Missoula	Plum Creek	West
IND-8	Lizard	Missoula	Plum Creek	West
IND-9	Eds Dread	Missoula	Plum Creek	West
IND-10	Shady Rest	Lake	Plum Creek	West
IND-11	Woodward Plateau	Lake	Plum Creek	West
IND-12	Upper Miller Line	Lincoln	Plum Creek	Northwest
IND-13	Meadow High Line	Lincoln	Plum Creek	Northwest
IND-14	Bastinity Line	Sanders	Plum Creek	West
IND-15	Upper Marl Cat	Lincoln	Plum Creek	Northwest
IND-16	Murr 31 Mech	Flathead	Plum Creek	Northwest
IND-17	30 Fawn Line	Lincoln	Plum Creek	Northwest
IND-18	Boom-Boom	Lincoln	Plum Creek	Northwest
IND-19	Sodo Mojo	Lincoln	Plum Creek	Northwest
IND-20	Smokin	Lincoln	Plum Creek	Northwest
IND-21	Tonghough	Lincoln	Plum Creek	Northwest
NIPF-1	R-Y Kimpton	Jefferson	PVT	Central
NIPF-2	Grande Ranch	Meagher	PVT	East
NIPF-3	R-Y Goodrich	Meagher	PVT	East
NIPF-4	Dixon/Rostad	Meagher	PVT	East
NIPF-5	Spear T	Fergus	PVT	East
NIPF-6	Rouns #2	Fergus	PVT	East
NIPF-7	Irish Harvest	Fergus	PVT	East
NIPF-8	Davis Harvest	Lincoln	PVT	Northwest
NIPF-9	Persson Harvest	Lincoln	PVT	Northwest
NIPF-11	Tavenner Harvest	Powell	PVT	Central
NIPF-10	Munis Harvest	Granite	PVT	Central
NIPF-12	Spellman Harvest	Ravalli	PVT	West

APPENDIX D

SAMPLE AUDIT SITE INFORMATION FORM

BMP AUDIT SITE INFORMATION FORM
NIPF

Please complete this sheet for each site that meets minimum criteria (see back for instructions).
Please attach a sale area map for each site. Highlight or otherwise identify new road construction/reconstruction and Streamside Management Zones
All references to streams and Streamside Management Zones based on SMZ Law (see back)

Minimum Criteria

(1) Timber harvested during **Calendar Years** 1999, 2000, 2001 **and**
(2) Some portion of the sale (cutting unit) is located within 200 feet of a stream, **and**
(3) Minimum size of 5 acres and 5,000 BF/acre (westside), 3,000 BF/acre (eastside) harvested

Land Owner Name _____ Phone # _____
Agreement Number _____
Sale Name _____
Legal Description Section _____ TWN _____ RNG _____County_____
Primary Drainage _____

New Road Construction (Since 1997) Yes___ No___ Miles _____ Yr. Complete_____
Reconstruction Yes ___ No ___ Miles _____ Yr. Complete_____
Stream Crossing Culvert Installation (New) Yes ___ No ___
Stream Crossings On Road System Yes ___ No ___
Slash Disposal Complete Yes ___ No ___
Average MBF Volume/Acre Removed From Harvested Area _____MBF

Stream Within 200 Feet Of A Harvest Unit Yes ____No ____
Are SMZ's (SMZ Law Definition) Delineated Yes ____ No ____
Riparian Harvest Yes ___ No ___
Stream(s) Name_____
Stream Class (SMZ Law Definition) _____

Month/Year Harvest Conducted: From_____ To _____
Range Of Average Slopes For Individual Harvest Units: From_____ To _____

Geologic Parent Material (Circle any present)

Granitics Alluvium Lacustrine Shist Soft/Hard Sediments Basic Igneous

Skidding/Yarding Method (Circle all used)

Tracked Equipment Rubber Tired Equipment Partial Suspension Full Suspension

Harvest Methods Used (Circle any used) Partial Cut Clearcut

APPENDIX E

2002 BMP FIELD AUDITS
RISK RATING GUIDE

MONTANA "RISK" MATRIX (5/02)

TYPE		CLEAR-CUT				PARTIAL CUT				SITE PREP			ROADS	
SLOPE	SOIL EROD.	TERQAUCIKPED	RSUKBIBDER	PSAURSTPIAL	FSUULSLP	TERQAUCIKPED	RSUKBIBDER	PSAURSTPIAL	FSUULSLP	MPACHINE/SCAR	BBRUDRCAST	OTHER	PERM	TEMP
0-5%	H	2	2	2	1	2**	2**	1	1	2	1	1	2**	3
	M	2	1	1	1**	2	1**	1	1	2**	1	1	1	1
	L	1	1	1	1	1	1	1	1	2	1	1	1	1
5-20%	H	4	3	2	1	4*	3	2	1	4	2	1	3	4
	M	3	2	1	1	3*	2	1	1	3	2	1	2	3
	L	2	2	1	1	2*	2*	1	1	2	1	1	2	2
20-40%	H	5	5	4*	2	5*	5*	3**	1	5	3**	1	4	5
	M	4*	4	3	1	3	3	2	1	4	3	1	3	4*
	L	3*	2	2	1	2	2	2	1	3	2	1	3*	3
>40%	H	5	5	4	2	5	5	4	2	5	4	1	5	5
	M	5	5	4	2*	5	5	3	1	5	4	1	5	5
	L	4	4	3	1	4	4	2	1	4	3*	1	4	4

(* Indicates Mean Value Used, ** Final Group Consensus Adjustment for Internal Consistency)

MONTANA EROSION-IMPACT MATRIX

From: "Management Guidelines for Riparian Forests" by Robert Pfister and Kim Sherwood. Flathead Basin Forest Practices Water Quality and Fisheries Cooperative Program.

LEGEND

1 = LOW RISK 2-3 = MODERATE RISK 4-5 = HIGH RISK

SOIL ERODIBILITY

HIGH ERODIBILITY	MODERATE ERODIBILITY	LOW ERODIBILITY
GRANITICS	SCHIST	ARGILLITE/QUARTZITE
ALLUVIUM	SOFT/HARD SEDIMENTS	METAMORPHIC (BELT)
LACUSTRINE	BASIC IGNEOUS	

HIGH RISK DUE TO RIPARIAN HARVEST

"HIGH" risk will be assigned to sales with logging in SMZ's or riparian zones along streams. Riparian zones are located between aquatic and terrestrial environments are identified by distinct vegetation that requires or tolerates free or unbound water. This includes but is not limited to the habitat types listed on the back of this matrix.

APPENDIX F

BMP AUDIT TEAM MEMBERSHIP
2002 Audits
As of May 20, 2002

	NORTHWEST	WEST	CENTRAL	EAST
FISHERIES	Scott Rumsey, DFWP+ (Tom Weaver, DFWP)+ (Mike Hensler, DFWP)+	Duane Phinney DFWP+ (Chris Clancy, DFWP)+ (Shane Hendrickson, USFS)	Don Skaar, DFWP+ (Scott Opitz, DFWP)+	Michael Enk, USFS+ Len Walch, USFS
HYDROLOGY	Steve Johnson, USFS+ (Brian Sudgen, PCTC)+	**Gary Frank, DNRC+*** (Renee Hanna, DNRC) (Bruce Sims, USFS)	**Steve Hayes, PCTC+*** (Marc Vessar, DNRC)	Bo Stuart, USFS+ John Hamann, USFS+
SOILS	Bill Basko, USFS+ Lou Kuennen, USFS	Tim Wiersum NCRS+ (Neil Svendsen, NRCS)+	Jeff Collins, DNRC+ (Hal Hunter, PVT)+	Bob Logar, NRCS+ (Sue Farley, USFS)
FORESTRY	(Allen Wolf), DNRC+ (Scott Hicswa, Stoltze) (Russ Hudson, PVT)+	Dick Wick, PCTC+ Jim Mountjoy, Smurfit+	Dwight Crawford , LP (Steve Flynn, LP)+	Gordy Sanders, PML+ (Gary Ullman, LP) (Craig Kamps, LP) (Don Kasten, BIA)
ENGINEERING AND ROADS	**Vic Andersen**, PCTC+* (Ron Buentimeier, Stoltze)+	Jennifer Swan, USFS Rhett Parker, PCTC	D.J. Bakken, DNRC + (Bob Vlahovich, DNRC)	**Dennis Davaz , R-Y +*** Mike Montgomery, PVT +
CONSERVATION	(Tom Hope, TU)+ (Hannah Hernandez, MT. Wild)	Marnie Criley, Wild. CPR + (Bob Benson, CFC)+	Brad Borst, MEIC Noorjahan Parwana, MLR	
NIPF/LOGGER	Mike Schlegel, MLA+ Pat Kearney, MLA +	Fred Hodgboom, MFOA + (Thorn Liechty, MFOA) +	Russ Gregory, MFOA+ (Cynthia Kingston, MFOA)+	Doug Mote, PVT+ Jerry Kelly, PVT

\+ Denotes Past Experience
* Denotes Team Leader
(*) Denotes Alternate Team Leader
() Denotes Alternate Team Member

APPENDIX G

DS-49
Rev 1/02

BMP FIELD AUDITS
SITE INFORMATION

Site Number: _____ Meets Selection Criteria: Y/N _____
High Hazard: Y/N _____: Riparian _____Matrix____

Site Name: _____

Owner(s): _____

Legal Description: _____ County: _____

Primary Drainage: _____ Month/Year Harvested: _____

Stream Within 200 Ft.? Y / N Name: _____ Bankfull Width: _____

Unit Size: _____ Volume Removed: _____

Road Construction: _____ Length: _____

Road Reconstruction: _____ Length: _____

Slash Disposal Complete: _____ Method: _____

Logging Method: _____

Slope: 0-5%_____; 5-20%_____; 20-40%_____; 40%+_____

Parent Material: _____

Soil Erodibility: High____ Medium____ Low____

Harvest in SMZ: Y / N

Stream Class: _____

Comments:

FIELD AUDIT

Date: _____

Team Leader/Recorder: _____

Team Members:

Observers Present:

Rating Guide

APPLICATION
5—Operation Exceeds Requirements Of Bmp
4—Operation Meets Requirements Of Bmp
3—Minor Departure From Bmp
2—Major Departure From Bmp
1—Gross Neglect Of Bmp

EFFECTIVENESS
5—Improved Protection Of Soil And Water Resources Over Pre-Project Condition
4—Adequate Protection Of Soil And Water Resources
3—Minor And Temporary Impacts On Soil & Water Resources
2—Major And Temporary Or Minor And Prolonged Impacts On Soil And Water Resources.
1—Major And Prolonged Impacts On Soil And Water Resources.

DEFINITIONS (BY EXAMPLE)
Adequate—Small amount of material eroded;
Material does not reach draws, channels, or floodplain.
Minor—Erosion and delivery of material to draws but not stream.
Major—Erosion and subsequent delivery of sediment to stream or annual floodplain.
Temporary—Impacts lasting one year or less; no more than one runoff season.
Prolonged—Impacts lasting more than one year.

NR – Not Reviewed NA – Not Applicable

MONTANA FOREST PRACTICES REVIEW WORKSHEET

BMPs Applicable to:

+ New Road Construction
# Existing Roads
➢ Reconstruction

RECOMMENDED BEST MANAGEMENT PRACTICES	APPLICABLE TO SITE (Y/N)	APPLICATION	EFFECTIVENESS	COMMENTS
SECTION III—ROADS				
ROAD PLANNING & LOCATION SECTION III. A.				
➢+ 1a. Minimize number of roads necessary.				
# 1b. Use existing roads unless aggravated erosion.				
+ 3. Avoid long, sustained, steep road grades.				
+ 4. Locations avoid high-hazard sites (i.e., wet areas and unstable slopes).				
+ 5a. Minimize number of stream crossings. Number _____.				
+ 5b. Choose stable stream crossing sites.				
ROAD DESIGN SECTION III.B.				
➢+ 2. Design roads to minimum standard necessary to accommodate anticipated uses.				
+ 4. Vary road grade to reduce concentrated drainage.				
ROAD DRAINAGE SECTION III. C.				
+➢# 1. Provide adequate road surface drainage for all roads.				
+➢ 2. Design ephemeral draw culverts with adequate length and size and to prevent erosion of fill. Minimum size 15" maintain cover.				
+➢# 3. Design all relief culverts with adequate length and appropriate skew. Protect inflow end from erosion. Catch basins where appropriate.				
+➢# 4. Install culverts at original gradient, otherwise rock armour or anchor downspouts.				
+➢# 5. Provide energy dissipaters at drainage structure outlets where needed.				
+➢# 7. Route road drainage through adequate filtration zones before entering a stream.				

MONTANA FOREST PRACTICES REVIEW WORKSHEET

BMPs Applicable to:

\+ New Road Construction

\# Existing Roads

➢ Reconstruction

	CONSTRUCTION/RECONSTRUCTION SECTION III. D.				
+➢	2. Stabilise erodible soils (i.e., seeding, benching, mulching).				
+➢	3. Provide effective sediment control on erodible fill slopes (ex. Slash filter windrow).				
+➢	5. Cut and fill slopes at stable angles. Slope ratio: _____.				
+➢	6. Avoid incorporating woody debris in road fill.				
+➢	8. Excess materials (waste) placed in locations that avoid entering stream.				
+➢	9. Sediment from borrow pits and gravel pits minimized.				
➢	10. Reconstruct only to the extent necessary to provide adequate drainage and safety.				
	ROAD MAINTENANCE SECTION III. E.				
+➢#	1. Grade roads as necessary to maintain drainage.				
+➢#	2. Maintain erosion control features (dips, ditches and culverts functional).				
#	3. Avoid cutting the toe of cut slopes.				
+➢#	6. Avoid use of roads during wet periods and spring breakup.				
+➢#	8. Abandoned roads in condition to provided adequate drainage without further maintenance.				
	SECTION IV - TIMBER HARVESTING				
	HARVEST DESIGN SECTION IV. A.				
	2. Suitable logging system for topography, soil type and season of operation.				
	5. Design and locate skid trails to avoid concentrating runoff.				
	6. Suitable location, size, and number of landings.				

MONTANA FOREST PRACTICES REVIEW WORKSHEET

BMPs Applicable to:

\+ New Road Construction

\# Existing Roads

➢ Reconstruction

	OTHER HARVESTING ACTIVITIES SECTION IV. B.				
1a.	Skidding operations minimizes soil compaction and displacement.				
1b.	Avoid tractor skidding on unstable slopes and slopes that exceed 40% unless not causing excessive erosion.				
2.	Avoid operation of equipment within isolated wetlands.				
4.	Adequate drainage for landing.				
5.	Adequate drainage for skid trails.				
	SLASH TREATMENT AND SITE PREPARATION SECTION IV. C.				
2.	Treat slash so as to preserve the surface soil horizon.				
4.	Scarify only to the extent necessary to meet resource management objective.				
5.	Activities limited to frozen or dry conditions to minimize soil compaction and displacement.				
6.	Equipment operations on suitable slopes only.				
8.	Limit water quality impact of prescribed fire.				
	SECTION V – STREAM CROSSINGS				
	LEGAL REQUIREMENTS SECTION V. A.				
➢+ 1.	Proper permits for stream crossings.				
	DESIGN CONSIDERATIONS SECTION V. B.				
➢+ 1a.	Cross streams at right angles, if practical.				
➢+ 1b.	Direct road drainage away from stream crossing site.				
➢+ 2.	Avoid unimproved stream crossings.				

MONTANA FOREST PRACTICES REVIEW WORKSHEET

BMPs Applicable to:

\+ New Road Construction

\# Existing Roads

➢ Reconstruction

INSTALLATION OF STREAM CROSSINGS SECTION V. C.					
➢+ 1.	Minimize stream channel disturbance.				
➢+ 2.	Stream crossing culverts conform to natural streamed and slope.				
➢+ 3.	Proper sizing for stream crossing structures.				
➢+ 4.	Prevent erosion of stream crossing culverts and bridge fills (i.e., armor inlet and outlet).				
➢+ 6.	Minimum cover for stream crossing culverts provided.				
	EXISTING STREAM CROSSING SECTION V. D.				
# 1.	Culverts shall meet 25-year capacity requirements. Adequate length to allow for road fill width. Rock armoring. Maintain fill over culvert.				
SECTION VII - HAZARDOUS SUBSTANCE					
GENERAL					
1.	Know and comply with regulations governing the storage, handling, etc. of hazardous substances.				
#	Project included road improvements to existing road system that reduced overall sediment delivery to streams.	Y/N Comment(s):			
+➢#	Road system contains third party road systems.	Y/N Comment(s)			

ADDITIONAL COMMENTS:

MONTANA FOREST PRACTICES REVIEW WORKSHEET

BMPs Applicable to:

\+ New Road Construction

\# Existing Roads

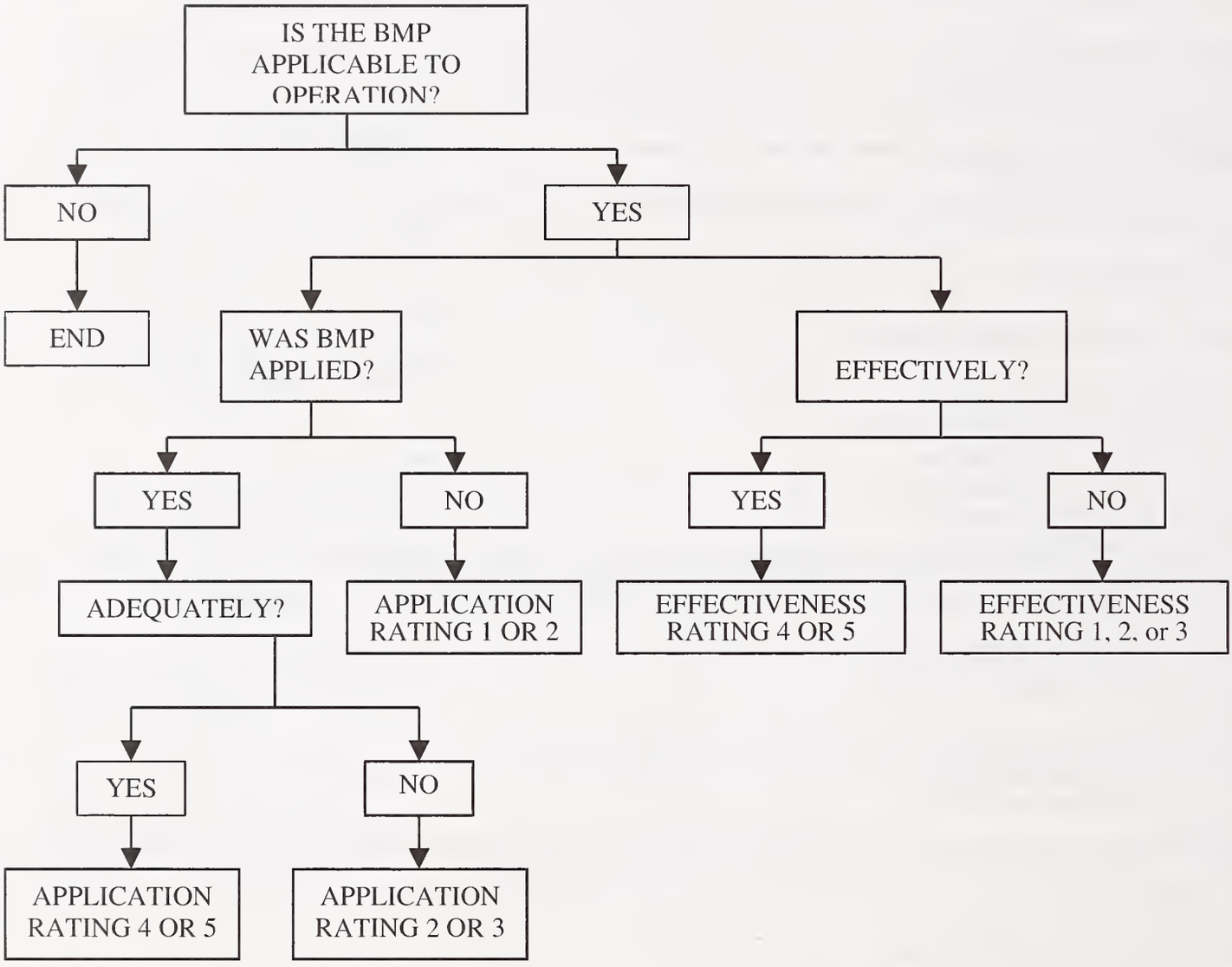
➢ Reconstruction

STREAMSIDE MANAGEMENT ZONE SITE INFORMATION				
Were any pre-approved alternative practices Utilized? (* Denotes practices that apply.)	Y / N (List applied practices)			
Were any DNRC – approved site-specific Alternative practices implemented in Harvest activities?	Y / N (List applied practices)			
RECOMMENDED BEST MANAGEMENT PRACTICES				COMMENTS
1a. Adequate SMZ width maintained, avg. width _____.				
1b. SMZ properly marked?				
2. Exclusion of broadcast burning in SMZ.				
3. SMZ retention tree requirements met. (# of trees, representative of pre-harvest stand, favor bank-edge and leaning trees, shrubs and sub merchantable).				
4. Exclusion of equipment operation in SMZ except on established roads.				
5. Exclude construction of roads in the SMZ except when necessary to cross a Stream or wetland.				
6. Exclusion of road fill material deposited in SMZ except as needed to construct crossings.				
7. Exclusion of side-casting of road material into a stream, lake, wetland or other body of water during road maintenance.				
8. Exclusion of slash in streams, lakes or other bodies of water.				
9. Exclude the handling, storage, application of disposal of hazardous or toxic materials in the SMZ in a manner that pollutes or causes damage or injury.				

ADDITIONAL COMMENTS:

APPENDIX H

RATIONALE FOR THE RATING SYSTEM
POST HARVEST EVALUATION



APPENDIX I

2000 BMP RATINGS BY PRACTICE AND OWNERSHIP GROUP

		APPLICATION						EFFECTIVENESS					
Practice	Owner	1	2	3	4	5	NR	1	2	3	4	5	NR
ROAD PLANNING													
Minimize #	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
of Roads	FED	0	0	0	4	0	1	0	0	0	4	0	1
III.A.1a	IND	0	0	0	20	0	1	0	0	0	20	0	1
	NIPF	0	0	0	12	0	0	0	0	0	12	0	0
	Total:	0	0	0	41	0	2	0	0	0	41	0	2
Use Existing	DNRC	0	0	0	4	1	0	0	0	0	4	1	0
Roads	FED	0	0	0	5	0	0	0	0	0	5	0	0
III.A.1b	IND	0	0	0	19	0	2	0	0	0	19	0	2
	NIPF	0	0	0	11	0	1	0	0	0	11	0	1
	Total:	0	0	0	39	1	3	0	0	0	39	1	3
Avoid Long,	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Steep Grades	FED	0	0	0	3	0	2	0	0	0	3	0	2
III.A.3	IND	0	0	0	19	0	2	0	0	0	19	0	2
	NIPF	0	0	0	10	0	2	0	0	0	10	0	2
	Total:	0	0	0	37	0	6	0	0	0	37	0	6
Avoid High	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Hazard Areas	FED	0	0	0	3	0	2	0	0	0	3	0	2
III.A.4	IND	0	0	0	19	0	2	0	0	0	19	0	2
	NIPF	0	0	0	10	0	2	0	0	0	10	0	2
	Total:	0	0	0	37	0	6	0	0	0	37	0	6
Minimize # of	DNRC	0	0	0	2	0	3	0	0	0	2	0	3
Stream X'ings	FED	0	0	0	1	0	4	0	0	0	1	0	4
III.A.5a	IND	0	0	0	16	0	5	0	0	0	16	0	5
	NIPF	0	0	0	7	0	5	0	0	0	7	0	5
	Total:	0	0	0	26	0	17	0	0	0	26	0	17
Choose	DNRC	0	0	0	2	0	3	0	0	0	2	0	3
Stable Stream	FED	0	0	0	1	0	4	0	0	0	1	0	4
Crossing Sites	IND	0	0	0	16	0	5	0	0	0	16	0	5
III.A.5b	NIPF	0	0	0	7	0	5	0	0	0	7	0	5
	Total:	0	0	0	26	0	17	0	0	0	26	0	17

2000 BMP RATINGS BY PRACTICE AND OWNERSHIP GROUP

		APPLICATION						EFFECTIVENESS					
Practice	Owner	1	2	3	4	5	NR	1	2	3	4	5	NR
ROAD DESIGN													
Minimum Design	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Standards	FED	0	0	0	4	0	1	0	0	0	4	0	1
III.B.2	IND	0	0	0	20	0	1	0	0	0	20	0	1
	NIPF	0	0	0	12	0	0	0	0	0	12	0	0
	Total:	0	0	0	41	0	2	0	0	0	41	0	2
Vary Grade	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
for Drainage	FED	0	0	0	3	0	2	0	0	0	3	0	2
III.B.4	IND	0	0	0	19	0	2	0	0	0	19	0	2
	NIPF	0	0	0	10	0	2	0	0	0	10	0	2
	Total:	0	0	0	37	0	6	0	0	0	37	0	6
ROAD DRAINAGE													
Adequate Sur-	DNRC	0	0	2	3	0	0	0	0	1	4	0	0
face Drainage	FED	0	2	1	2	0	0	0	2	1	2	0	0
III.C.1	IND	0	0	2	18	0	1	0	0	1	19	0	1
	NIPF	0	2	6	4	0	0	0	4	2	6	0	0
	Total:	0	4	11	27	0	1	0	6	5	31	0	1
Ephemeral	DNRC	0	0	0	2	0	3	0	0	0	2	0	3
Draws	FED	0	0	0	3	0	2	0	0	0	3	0	2
III.C.2	IND	0	0	1	13	0	7	0	0	0	14	0	7
	NIPF	0	0	1	2	0	9	0	0	0	3	0	9
	Total:	0	0	2	20	0	21	0	0	0	22	0	21
Relief	DNRC	0	0	0	2	0	3	0	0	0	2	0	3
Culverts	FED	0	1	1	3	0	0	0	1	1	3	0	0
III.C.3	IND	0	0	1	18	0	2	0	0	1	18	0	2
	NIPF	0	0	2	3	0	7	0	1	0	4	0	7
	Total:	0	1	4	26	0	12	0	2	2	27	0	12
Install	DNRC	0	0	0	3	0	2	0	0	0	3	0	2
Culverts	FED	0	0	1	4	0	0	0	0	1	4	0	0
III.C.4	IND	0	0	0	20	0	1	0	0	0	20	0	1
	NIPF	0	0	2	4	0	6	0	0	0	6	0	6
	Total:	0	0	3	31	0	9	0	0	1	33	0	9
Energy	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Dissip.	FED	0	0	1	3	0	1	0	1	0	3	0	1
III.C.5	IND	0	0	1	20	0	0	0	0	0	21	0	0
	NIPF	0	0	1	7	0	4	0	0	0	8	0	4
	Total:	0	0	3	35	0	5	0	1	0	37	0	5

2000 BMP RATINGS BY PRACTICE AND OWNERSHIP GROUP

Practice	Owner	APPLICATION 1	2	3	4	5	NR	EFFECTIVENESS 1	2	3	4	5	NR
Route Drainage Through SMZ III.C.7	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
	FED	0	1	2	1	0	1	0	2	1	1	0	1
	IND	0	0	2	19	0	0	0	1	1	18	1	0
	NIPF	0	1	1	8	0	2	0	1	1	8	0	2
	Total:	0	2	5	33	0	3	0	4	3	32	1	3
ROAD CONSTRUCTION													
Stabilize Erodible Soils III.D.2	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
	FED	0	1	0	3	0	1	0	1	0	3	0	1
	IND	0	0	0	20	0	1	0	1	0	19	0	1
	NIPF	0	0	0	12	0	0	0	0	0	12	0	0
	Total:	0	1	0	40	0	2	0	2	0	39	0	2
Sediment Control Erodible Fill Slopes III.D.3	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
	FED	0	1	1	1	0	2	0	2	0	1	0	2
	IND	0	0	1	19	0	1	0	0	1	19	0	1
	NIPF	0	0	0	11	0	1	0	0	0	11	0	1
	Total:	0	1	2	36	0	4	0	2	1	36	0	4
Slopes at Stable Angle III.D.5	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
	FED	0	1	1	2	0	1	0	0	0	3	0	2
	IND	0	0	0	19	0	2	0	1	0	19	0	1
	NIPF	0	0	2	9	0	1	0	0	1	10	0	1
	Total:	0	1	3	35	0	4	0	1	1	37	0	4
Avoid Incorporating Woody Debris in Road Fill III.D.6	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
	FED	0	0	1	3	0	1	0	0	1	3	0	1
	IND	0	0	0	20	0	1	0	0	0	20	0	1
	NIPF	0	0	1	11	0	0	0	0	0	12	0	0
	Total:	0	0	2	39	0	2	0	0	1	40	0	2
Overburden Placement III.D.8	DNRC	0	0	0	3	0	2	0	0	0	3	0	2
	FED	0	0	0	3	0	2	0	0	0	3	0	2
	IND	0	0	0	17	0	4	0	0	0	17	0	4
	NIPF	0	0	0	5	0	7	0	0	0	5	0	7
	Total:	0	0	0	28	0	15	0	0	0	28	0	15
Sediment From Borrow Pits III.D.9	DNRC	0	0	0	2	0	3	0	0	0	2	0	3
	FED	0	0	0	0	0	5	0	0	0	0	0	5
	IND	0	0	0	6	0	15	0	0	0	6	0	15
	NIPF	0	0	0	1	0	11	0	0	0	1	0	11
	Total:	0	0	0	9	0	34	0	0	0	9	0	34

2000 BMP RATINGS BY PRACTICE AND OWNERSHIP GROUP

		APPLICATION						EFFECTIVENESS					
Practice	Owner	1	2	3	4	5	NR	1	2	3	4	5	NR
Minimize	DNRC	0	0	0	4	0	1	0	0	0	4	0	1
Reconstruction	FED	0	0	0	4	0	1	0	0	0	4	0	1
III.D.10	IND	0	0	0	7	1	13	0	0	0	8	0	13
	NIPF	0	0	1	5	0	6	0	1	0	5	0	6
	Total:	0	0	1	20	1	21	0	1	0	21	0	21
ROAD MAINTENANCE													
Grade Roads	DNRC	0	0	1	4	0	0	0	0	0	5	0	0
for Drainage	FED	0	0	0	5	0	0	0	0	0	5	0	0
III.E.1	IND	0	0	0	21	0	0	0	0	0	21	0	0
	NIPF	0	0	0	12	0	0	0	0	0	12	0	0
	Total:	0	0	1	42	0	0	0	0	0	43	0	0
Erosion Control	DNRC	0	0	0	5	0	0	0	1	0	5	0	0
Functional	FED	0	0	2	3	0	0	0	0	1	3	0	0
III.E.2	IND	0	0	2	19	0	0	0	0	1	20	0	0
	NIPF	0	0	2	10	0	0	0	1	1	10	0	0
	Total:	0	0	6	37	0	0	0	2	3	38	0	0
Avoid Cutting	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Slope Toe	FED	0	0	0	5	0	0	0	0	0	5	0	0
III.E.3	IND	0	0	0	20	0	1	0	0	0	20	0	1
	NIPF	0	0	1	11	0	0	0	0	1	11	0	0
	Total:	0	0	1	41	0	1	0	0	1	41	0	1
Restrict Use	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
When Wet	FED	0	0	0	5	0	0	0	0	0	5	0	0
III.E.6	IND	0	0	0	21	0	0	0	0	0	21	0	0
	NIPF	0	0	0	12	0	0	0	0	0	12	0	0
	Total:	0	0	0	43	0	0	0	0	0	43	0	0
Adequate Drain.	DNRC	0	0	0	5	0	0	0	0	0	4	1	0
on Aband. Roads	FED	0	0	0	2	0	3	0	0	0	2	0	3
III.E.8	IND	0	0	0	6	1	14	0	0	0	6	1	14
	NIPF	0	1	0	3	0	8	0	1	0	3	0	8
	Total:	0	1	0	16	1	25	0	1	0	15	2	25

2000 BMP RATINGS BY PRACTICE AND OWNERSHIP GROUP

Practice	Owner	APPLICATION 1	2	3	4	5	NR	EFFECTIVENESS 1	2	3	4	5	NR
HARVEST DESIGN													
Logging Suits	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Topography	FED	0	0	0	5	0	0	0	0	0	5	0	0
IV.A.2	IND	0	0	0	21	0	0	0	0	0	21	0	0
	NIPF	0	0	0	12	0	0	0	0	0	12	0	0
	Total:	0	0	0	43	0	0	0	0	0	43	0	0
Skid Trail	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Design	FED	0	0	0	5	0	0	0	0	0	5	0	0
IV.A.5	IND	0	0	1	20	0	0	0	0	0	21	0	0
	NIPF	0	0	0	12	0	0	0	0	0	12	0	0
	Total:	0	0	1	42	0	0	0	0	0	43	0	0
Landing Size	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Location	FED	0	0	0	5	0	0	0	0	0	5	0	0
IV.A.6	IND	0	0	0	21	0	0	0	0	0	21	0	0
	NIPF	0	0	0	11	1	0	0	0	0	12	0	0
	Total:	0	0	0	42	1	0	0	0	0	43	0	0
OTHER HARVEST ACTIVITY													
Skid to Min.	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Displacing Soil	FED	0	0	0	5	0	0	0	0	0	5	0	0
IV.B.1a	IND	0	0	0	21	0	0	0	0	0	21	0	0
	NIPF	0	0	0	12	0	0	0	0	0	12	0	0
	Total:	0	0	0	43	0	0	0	0	0	43	0	0
Skid to Min.	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Compacting Soil	FED	0	0	0	4	0	1	0	0	0	4	0	1
IV.B.1b	IND	0	0	0	20	0	1	0	0	0	20	0	1
	NIPF	0	0	0	12	0	0	0	0	0	12	0	0
	Total:	0	0	0	41	0	2	0	0	0	41	0	2
Avoid Equip.	DNRC	0	0	0	0	0	5	0	0	0	0	0	5
In Iso. wetland	FED	0	0	0	2	0	3	0	0	0	2	0	3
IV.B.2	IND	0	0	0	10	0	11	0	0	0	10	0	11
	NIPF	0	0	0	3	1	8	0	0	0	4	0	8
	Total:	0	0	0	15	1	27	0	0	0	16	0	27
Adequate Drain.	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
for Landings	FED	0	0	0	5	0	0	0	0	0	5	0	0
IV.B.4	IND	0	0	0	21	0	0	0	0	0	21	0	0
	NIPF	0	0	0	12	0	0	0	0	0	12	0	0
	Total:	0	0	0	43	0	0	0	0	0	43	0	0

2000 BMP RATINGS BY PRACTICE AND OWNERSHIP GROUP

		APPLICATION						EFFECTIVENESS					
Practice	Owner	1	2	3	4	5	NR	1	2	3	4	5	NR
Adequate Drain.	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
for Skid Trails	FED	0	0	0	5	0	0	0	0	0	5	0	0
IV.B.5	IND	0	0	0	20	1	0	0	0	0	21	0	0
	NIPF	0	0	1	11	0	0	0	0	0	12	0	0
	Total:	0	0	1	41	1	0	0	0	0	43	0	0
SITE PREPARATION													
Brush Blades	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Used	FED	0	0	0	5	0	0	0	0	0	5	0	0
IV.C.2	IND	0	0	0	20	0	1	0	0	0	20	0	1
	NIPF	0	0	0	12	0	0	0	0	0	12	0	0
	Total:	0	0	0	42	0	1	0	0	0	42	0	1
Scarify Only	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
to Extent	FED	0	0	0	4	0	1	0	0	0	4	0	1
Necessary	IND	0	0	0	18	0	3	0	0	0	18	0	3
IV.C.4	NIPF	0	0	0	12	0	0	0	0	0	12	0	0
	Total:	0	0	0	39	0	4	0	0	0	39	0	4
Compaction and	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Displacement	FED	0	0	0	5	0	0	0	0	0	5	0	0
Minimized	IND	0	0	0	19	0	2	0	0	0	19	0	2
IV.C.5	NIPF	0	0	0	12	0	0	0	0	0	12	0	0
	Total:	0	0	0	41	0	2	0	0	0	41	0	2
Equipment	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Operation	FED	0	0	0	5	0	0	0	0	0	5	0	0
On Suitable	IND	0	0	0	19	0	2	0	0	0	19	0	2
Slopes Only	NIPF	0	0	0	12	0	0	0	0	0	12	0	0
IV.C.6													
	Total:	0	0	0	41	0	2	0	0	0	41	0	2
Limit WQ Impact	DNRC	0	0	0	3	0	2	0	0	0	3	0	2
of Fire	FED	0	0	0	5	0	0	0	0	0	5	0	0
IV.C.8	IND	0	0	0	21	0	0	0	0	0	21	0	0
	NIPF	0	0	0	8	0	4	0	0	0	8	0	4
	Total:	0	0	0	37	0	6	0	0	0	37	0	6

2000 BMP RATINGS BY PRACTICE AND OWNERSHIP GROUP

Practice	Owner	APPLICATION 1	2	3	4	5	NR	EFFECTIVENESS 1	2	3	4	5	NR
STREAM CROSSINGS													
Proper Permit	DNRC	0	0	0	2	0	3	0	0	0	2	0	3
Obtained	FED	0	0	0	0	0	5	0	0	0	0	0	5
V.A.1	IND	0	0	0	14	0	7	0	0	0	14	0	7
	NIPF	0	0	0	6	0	6	0	0	0	6	0	6
	Total:	0	0	0	22	0	21	0	0	0	22	0	21
STREAM XING DESIGN													
Cross Stream	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
at Right Angle	FED	0	0	0	2	0	3	0	0	0	2	0	3
V.B.1a	IND	0	0	0	17	0	4	0	0	0	17	0	4
	NIPF	0	0	0	9	0	3	0	0	0	9	0	3
	Total:	0	0	0	33	0	10	0	0	0	33	0	10
Direct Drainage	DNRC	0	0	1	4	0	0	0	0	1	4	0	0
Away From	FED	0	0	1	1	0	3	0	1	0	1	0	3
Stream Crossing	IND	0	0	0	17	0	4	0	1	0	16	0	4
V.B.1b	NIPF	0	3	2	4	0	3	1	2	1	5	0	3
	Total:	0	3	4	26	0	10	1	4	2	26	0	10
Avoid Unimproved	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Crossings	FED	0	0	0	2	0	3	0	0	0	2	0	3
V.B.2	IND	0	0	0	17	0	4	0	0	0	17	0	4
	NIPF	0	0	0	7	1	4	0	0	0	8	0	4
	Total:	0	0	0	31	1	11	0	0	0	32	0	11
STREAM XING INSTALLATION													
Min. Channel	DNRC	0	0	0	4	1	0	0	0	0	5	0	0
Disturbance	FED	0	0	0	2	0	3	0	0	0	2	0	3
V.C.1	IND	0	0	0	16	1	4	0	0	0	17	0	4
	NIPF	0	0	0	8	0	4	0	0	0	8	0	4
	Total:	0	0	0	30	2	11	0	0	0	32	0	11
Culverts Conform	DNRC	0	0	0	4	0	1	0	0	1	3	0	1
to Streambed	FED	0	0	0	2	0	3	0	0	0	2	0	3
Slope	IND	0	0	0	15	0	6	0	0	0	15	0	6
V.C.2	NIPF	0	0	1	4	0	7	0	1	0	4	0	7
	Total:	0	0	1	25	0	17	0	1	1	24	0	17

2000 BMP RATINGS BY PRACTICE AND OWNERSHIP GROUP

		APPLICATION						EFFECTIVENESS					
Practice	Owner	1	2	3	4	5	NR	1	2	3	4	5	NR
Proper Sizing	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
For Crossing	FED	0	0	0	2	0	3	0	0	1	1	0	3
Structures	IND	0	0	0	16	1	4	0	0	1	16	0	4
V.C.3	NIPF	0	0	0	7	0	5	0	0	1	6	0	5
	Total:	0	0	0	30	1	12	0	0	3	28	0	12
Prevent Fill	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Erosion	FED	0	0	0	2	0	3	0	0	0	2	0	3
V.C.4	IND	0	0	1	15	1	4	0	1	0	15	1	4
	NIPF	0	0	1	6	0	5	0	0	0	7	0	5
	Total:	0	0	2	28	1	12	0	1	0	29	1	12
Adequate Cover	DNRC	0	0	0	4	0	1	0	0	0	4	0	1
for Culverts	FED	0	0	0	2	0	3	0	0	0	2	0	3
V.C.6	IND	0	0	0	16	0	5	0	0	0	16	0	5
	NIPF	0	0	2	3	0	7	0	0	0	5	0	7
	Total:	0	0	2	25	0	16	0	0	0	27	0	16
Existing	DNRC	0	0	1	0	0	4	0	0	0	1	0	4
Culverts	FED	0	2	0	2	0	1	0	2	0	2	0	1
V.D.1	IND	0	0	3	11	0	7	0	0	1	12	1	7
	NIPF	0	1	0	1	0	10	1	0	0	1	0	10
	Total:	0	3	4	14	0	0	1	2	1	16	1	22
HAZARDOUS SUBSTANCES													
Proper Storage	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
and Disposal	FED	0	0	0	5	0	0	0	0	0	5	0	0
VII.1	IND	0	0	0	20	0	1	0	0	0	20	0	1
	NIPF	0	0	0	10	0	3	0	0	0	10	0	2
	Total:	0	0	0	40	0	3	0	0	0	40	0	3
GRAND	TOTALS:	0	17	59	1,656	11	407	2	30	25	1,680	6	407

APPENDIX J

SUMMARY OF 2002 AUDIT DEPARTURES AND IMPACTS BY BMP

BMP Sec	BMP Sub	BMP	APP 2	APP 3	**APP Tot**	EFF 1	EFF 2	EFF 3	**EFF Tot**	**Grand Tot**
* III	C	1	4	11	**15**		6	5	**11**	**26**
V	B	1B	3	4	**7**	1	4	2	**7**	**14**
III	C	7	2	5	**7**		4	3	**7**	**14**
V	D	1	3	4	**7**	1	2	1	**4**	**11**
* III	E	2		6	**6**		2	3	**5**	**11**
III	C	3	1	4	**5**		2	2	**4**	**9**
III	D	3	1	2	**3**		2	1	**3**	**6**
III	D	5	1	3	**4**		1	1	**2**	**6**
III	C	5		3	**3**		1		**1**	**4**
III	C	4		3	**3**			1	**1**	**4**
* III	D	2	1		**1**		2		**2**	**3**
V	C	2		1	**1**		1	1	**2**	**3**
* V	C	4		2	**2**		1		**1**	**3**
III	D	6		2	**2**			1	**1**	**3**
V	*C*	*3*			***0***			*3*	***3***	***3***
III	E	3		1	**1**			1	**1**	**2**
III	E	8	1		**1**		1		**1**	**2**
IV	A	5		1	**1**				**0**	**1**
III	C	2		2	**2**				**0**	**2**
V	C	6		2	**2**				**0**	**2**
III	*D*	*10*		*1*	***1***		*1*		***1***	***2***
III	E	1		1	**1**				**0**	**1**
* IV	B	5		1	**1**				**0**	**1**
			17	**59**	**76**	**2**	**30**	**25**	**57**	**133**

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